Pretend or Amend? On Evergreening in CRE*

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Abstract

Banks can use loan modifications to either genuinely ease distress or to merely mask looming credit losses ("extend and pretend"). Examining commercial real estate (CRE) loans after the COVID-19 shock, I find little support for the extend and pretend view. I use loan level supervisory data to demonstrate that (i) banks *reduced* extensions for the most troubled loans during the stress period; (ii) banks tightened terms for extensions during that period, demanding higher spreads and new equity contributions rather than granting subsidized credit; (iii) loans extended during the stress period paid off at high rates relative to prepandemic extensions and (iv) less-capitalized banks did not have more lenient extension policies. I construct a model of maturity extensions, and show that these patterns are more consistent with banks mitigating the effects of market illiquidity, rather than delaying loss recognition.

Keywords: commercial real estate, banks, evergreening

JEL Classification: E44, G21, R33

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1. INTRODUCTION

In many models of financial intermediation, the defining feature of bank credit is greater flexibility to renegotiate loan terms (see, for example, Rajan, 1992 and Hackbarth et al., 2007). Loan modifications can reduce banks' credit losses by replacing more costly resolution methods (Bolton and Scharfstein, 1996).[1] However, this flexibility can be a double-edged sword; if banks modify loans to hide impairment rather than mitigate losses, these "zombie" loans can produce credit misallocation (Peek and Rosengren, 2005; Caballero et al., 2008), financial stability risks (Bruche and Llobet, 2014), and economic sclerosis (Acharya et al., 2021).

Distinguishing between these types of modifications has become particularly important in recent years, as CRE market strains created need for loss-mitigating modifications at the same time that regional bank strains potentially motivated loss-obscuring ones. While communications from regulators have emphasized the benefits of working proactively with stressed borrowers (Federal Reserve System et al., 2023), others have noted the risk of more pernicious modifications that could harm banks down the road (Jiang et al., 2024; Crosignani and Prazad, 2024).

In this paper, I investigate whether bank CRE loan extensions align more with "amend and extend" behavior, whereby banks restructure loans to improve future repayment prospects, or "extend and pretend" behavior, where the goal is delayed loss recognition. I begin by presenting a model of maturity extensions that incorporates the various motivations banks might have for providing extensions. In the model, banks may extend loans to delay loss recognition (Crosignani and Prazad, 2024), avoid deadweight insolvency costs (Faria-e Castro et al., 2024) or give borrowers more time to find a suitable buyer (Sagi, 2021). In deciding the extension terms to offer, banks weigh these benefits against debt overhang costs from undercapitalized borrowers failing to maintain the property (Myers, 1977).

The model demonstrates that lenders' motivation for providing extensions can be inferred by the relationship between a loan's debt yield—net operating income (NOI) as a share of the loan balance—and the principal paydown required for an extension. Lenders looking to delay loss recognition need to provide subsidized terms to highly-stressed borrowers to motivate those borrowers to accept extensions rather than default. Borrowers with weaker incomes therefore receive forbearance from required payments. In contrast, extensions that remedy frictions selling or refinancing a property go to owners that are motivated to retain the property. Terms for these extensions are determined by lenders' desired credit enhancements (rather than borrowers' participation constraints) and thus borrowers with weaker incomes are required to offer *larger* paydowns to mitigate repayment risks.

Ultimately, the model produces four testable implications regarding how an increase in extend and pretend incentives would materialize in the data. If banking sector strains encouraged banks to delay loss recognition, we would expect to

[1] This ability to mitigate losses by renegotiating loan terms can, in turn, account for the selection of smaller (Hackbarth et al., 2007), riskier (Black et al., 2020) or more liquidity constrained (Glancy et al., 2025) borrowers into banks.

see (i) an increase in extensions during the stress period, (ii) more extensions for highly-strained (i.e., low debt yield) borrowers, (iii) easier extensions terms (i.e., less principal curtailment) for those strained borrowers, and (iv) a lower share of extended loans eventually paying off.

I test these predictions using detailed supervisory data on bank CRE loan holdings. I start by testing whether they hold for the sample as a whole. I then examine differences by bank capitalization since banks closer to their capital requirement might have greater incentives to delay loss recognition. Overall, I find that observed extension patterns are not consistent with extend and pretend behavior.

First, I examine outcomes of pending maturities to test whether extensions either became more common or shifted towards riskier loans following the 2023 bank stress episode. Between 2023 and 2025, banks extended a large share of loans (roughly half) as they matured. However, this behavior was not unusual; banks extended a similar share of loans before COVID, and even more at the onset of the pandemic. Thus loan extensions are not merely a response to the stress, but a persistent feature of bank loan servicing.

Regarding differences by risk, banks *reduced* extensions for low-debt-yield properties during the stress period, the opposite of what the model predicts would have occurred if banking sector pressures encouraged banks to delay loss recognition. Moreover, the rise in extensions was concentrated in loans against industrial and multifamily properties, which generally had the strongest performance coming out of the pandemic.

Second, I analyze the terms of extensions. As the model demonstrates, banks that want to delay loss recognition provide lenient terms to the lowest quality borrowers because they are the most likely to otherwise default and would cause the largest losses were they to default. Instead, I find that riskier firms need to pay for extensions by providing credit-enhancements that improve banks' future return prospects. Borrowers were more likely to pay down principal or accept higher loan spreads as a part of an extension during the stress period. Moreover, this tightening in terms was most pronounced for loans with other risk characteristics such as low debt yields, office collateral, or nonrecourse clauses. Principal paydowns reduce losses if a borrower eventually defaults, and, since they are costly to borrowers should they default anyway, signal that borrowers are committed to retaining the property.

Third, I examine how loans perform following extensions. While the first set of results demonstrate that the quality of extensions rose on observed margins, it is still possible that banks extended loans with unobserved factors that make repayment unlikely.[2] While stress-era extensions were less likely to pay off in the year following the extension than prepandemic extensions, this effect reflects a general deterioration in loan performance during the stress period. Once such effects are controlled for, I find that stress-era extensions performed slightly better than prepandemic ones,

[2]For example, a loan against an empty office could have a high debt yield until leases expire and tenants can cease paying rent (Glancy and Wang, 2023). Borrowers might be willing to pay down the principal to extend the loan and keep collecting those cash flows even if pending vacancies leave little hope for the loan paying off.

consistent with the findings that stress-era extensions went to higher-quality properties and were more likely to include enhancements to bolster future repayment prospects.

While aggregate patterns are inconsistent with lenient extension policies driving pandemic-era extensions, this does not rule out such behavior for some lenders. For the final piece of analysis, I follow Crosignani and Prazad (2024) and examine differences in extension patterns by bank capitalization. I show that banks with low capital ratios behave similarly to the broader sample. If anything, worse-capitalized banks reduced extensions relative to better-capitalized banks during the stress period while tightening extension terms to a similar extent.

1.1. Related literature

This paper contributes to three strands of literature. First, it contributes to work on risks posed to the banking sector by CRE market strains. Though it is well understood that changes in interest rates and remote work tendencies generated severe CRE valuation declines (Gupta et al., 2022), the extent of banks' exposure to CRE losses is up for debate. Jiang et al. (2023) find that potential CRE losses place many small banks at the risk of solvency runs. However, realized bank delinquencies are lower than one might expect given the extent of valuation declines (Hinzen et al., 2025), raising the question why bank CRE loan performance hasn't deteriorated more. Jiang et al. (2023); Crosignani and Prazad (2024) provide evidence that extend and pretend behavior contributes to banks' relatively modest delinquency rates. However, Glancy and Kurtzman (2024) find that much of small and regional banks' strong performance can be attributed to portfolio composition—most notably, their minimal holdings of high-risk office loans—leaving less room for extend and pretend behavior to explain delinquency patterns.

This paper relates most closely to Crosignani and Prazad (2024), which also uses supervisory data on large banks' CRE loan holdings to analyze extend and pretend behavior following the pandemic. They show that worse-capitalized banks were more likely to extend loans that suffered income declines. There are two key differences in this study: First, I focus predominantly on the behavior of the sample as whole rather than differences across banks. This approach allows me to avoid two difficulties with using cross-lender variation: (i) limited statistical power due to the small number of Y-14 reporters, and (ii) complications identifying aggregate effects due to the missing intercept problem. Though Crosignani and Prazad (2024) provide evidence that capital considerations induced some banks to extend loans on the margin—in turn crowding out new lending—my results indicate that extend and pretend behavior was small in aggregate. Second, I analyze terms, in addition to frequencies, of extensions. Extensions can either amplify or moderate ultimate credit losses depending on the strategy banks employ, and I demonstrate that terms are informative for identifying which. I show that patterns in principal paydowns are consistent with banks providing efficient extensions to relieve the effects of search frictions.

Second, I relate to a broader literature on evergreening/zombie lending. This work demonstrates that weakly capitalized banks extend credit to underperforming firms to avoid writing off existing loans (Peek and Rosengren, 2005; Caballero et al., 2008) and the resulting distortion in credit allocation has negative macroeconomic consequences (Acharya et al., 2021, 2022). Zombie firms are typically defined by having some combination of income strains and subsidized credit (Adalet McGowan et al., 2018; Acharya et al., 2019). This notion aligns well with extend and pretend modifications in the model, which are characterized by low debt yields and lenient principal repayment requirements. My findings complement Favara et al. (2024), which uses similar data on commercial and industrial lending to show that large U.S. banks do not engage in zombie lending regardless of capitalization. A couple of factors might contribute to the apparent lack of zombie lending in this setting. First, the banks in the sample are generally well-capitalized, and thus lack the severe stresses and potential gambling for resurrection incentives that were in place in episodes typically associated with zombie lending (i.e., the Japanese financial crisis and European sovereign debt crisis). Second, the banks we study are subject to stress tests which should dampen extend and pretend incentives since projected losses from stressed extensions would add to banks' capital requirements.[3]

Finally, I contribute to work analyzing the servicing of distressed CRE loans. Brown et al. (2006) shows that sales of foreclosed CRE properties occur at substantial discounts relative to fundamental values, motivating lenders to renegotiate loans. Black et al. (2017, 2020) document that banks have an advantage in renegotiating CRE loans (relative to CMBS), and Glancy et al. (2025) provide evidence that such modifications supported loan performance at the onset of the pandemic.[4] This work generally assumes that lenders set modification policies to maximize loan recoveries, but does not touch on distinguishing this motivation from extend and pretend considerations.

The rest of the paper proceeds as follows: Section 2 presents a model of loan extensions, and derives equilibrium extension terms and maturity outcomes. Section 3 describes the data and methodology. Section 4 presents the empirical findings. Section 5 concludes.

2. MODEL

2.1. *Setup*

To aid in the interpretation of observed loan extension patterns, I develop a dynamic model of CRE maturity outcomes where borrowers and lenders negotiate extension terms in order to navigate various market frictions. All parties are risk neutral and have a discount factor of $\beta = (1+r)^{-1}$. The timing of the model is as follows: At the end of a period, a nonrecourse loan with an outstanding balance D against a property with NOI N is scheduled to mature. The lender makes an offer to extend the loan for another period, choosing a principal paydown of pD as a condition of the extension. A value of $p = 1$ signifies that the lender rejects an extension, demanding full repayment.

[3] Delaying loss recognition by rolling over risky loans could preserve capital by avoiding losses. However, the expected losses from these risky loans in a severe recession would result in a higher stress capital buffer, counteracting the ability of extensions to preserve capital buffers.

[4] Relatedly, Flynn et al. (2024); Dinc and Yönder (2022) analyze strategic renegotiation on the part of borrowers.

Next, the borrower solicits bids on the property and receives an offer to purchase the property at a cap rate (NOI over property value) of κ.[5] Borrowers can therefore sell the property for N/κ, and use the proceeds to pay back the loan and accumulated interest $(1+r_m)D$, where r_m is the mortgage rate. Rent is paid after sales occur, so $\underline{\kappa} \equiv (r-g)/(1+r)$ is the cap rate that would equate the sale price with the present discounted value of cash flows, where g is per period expected income growth.

If the borrower rejects the sale offer, they can then either default, and forfeit the property, or accept the extension. If they extend the loan, they collect the income flow N, make the required principal and interest payments $(r_m+p)D$, and repeat the game next period with $D' = (1-p)D$ and a new N' which has both a stochastic component and endogenous component (reflecting maintenance incentives), to be discussed soon.

2.2. *Strategies and payoffs*

I incorporate several frictions into the model to account for the various motivations parties might have to extend loans at maturity.

1. **Search frictions**: κ is stochastic, creating the risk that borrowers receive a weak offer when their loan comes due. Extensions deal with this liquidity risk by giving borrowers time to shop for a better offer. I assume κ follows a Pareto distribution: $G(\kappa|\kappa \geq \underline{\kappa}) = 1 - (\underline{\kappa}/\kappa)^{\alpha}$, where α parameterizes market liquidity. As $\alpha \to \infty$, the distribution of offers converges to $\underline{\kappa}$, meaning the borrowers can always sell at the fair price of a property. The expected purchase offer is $\mathbb{E}(N/\kappa) = [\alpha/(1+\alpha)]N/\underline{\kappa}$, meaning an expected proportional discount of $1/(1+\alpha)$ if forced to sell in a particular period. While I discuss this process in terms of search for a buyer, this mechanism could also capture search for a refinance, with κ reflecting whether the a new loan offer is sufficient to refinance the outstanding loan.

2. **Foreclosure costs**: If lenders foreclose, they expect to recover $\Lambda N/\underline{\kappa}$, where $\Lambda \leq \alpha/(1+\alpha)$, meaning that banks' recovery in foreclosure is less than would be expected from selling a property in a given period. Foreclosure costs create a discontinuous drop in lender payouts at the default threshold. Consequently, extensions may reduce expected losses by giving the loan an opportunity to recover.[6]

3. **Delayed Loss Recognition**: Lenders may face a cost to realizing losses (e.g., due to equity issuance costs or lost opportunities from binding capital constraints). I incorporate this as an additional cost of $\chi(D-\Lambda N/\underline{\kappa})$ that lenders face if borrowers default. Since χ reflects the benefit to *delaying* losses, I model this as a one period MIT shock to lenders' flow returns that does not affect payouts in future periods.

[5] Drawing a cap rate of κ is identical to pulling a value multiple of $1/\kappa$. I express values in terms of cap rates because it complements the focus on debt yields as the measure of loan risk; debt yield can be interpreted as the cap rate below which a borrower could sell a property to pay off a loan's principal. Namely, $\kappa \equiv N/V < N/D \implies V > D$, where V is the sale price and N/D the debt yield.

[6] More formally, the discontinuous drop in loan values at the default threshold (absent an extension) causes loan values to be convex in N. Lenders are willing to extend loans since increases in N raise loan values more than declines reduce it.

The final element that I include in the model is debt overhang problems in the form of deferred maintenance. While the aforementioned elements generate benefits to extensions, endogenizing maintenance introduces a countervailing cost to them. Borrowers are able to receive an additional cash flow νN by neglecting maintenance, but this action reduces N' by a factor θ, permanently lowering cash flows. ν and θ are such that the return to proper maintenance is high. However, borrowers that expect to default in the near future will not prioritize future cash flows and try to extract as much as they can prior to default. This mechanism imposes a cost to lenders of providing extensions against stressed properties.

Regarding players' strategies, lenders choose the terms to provide on potential extensions. For low values of N, borrowers may reject extensions even for $p = 0$ since the continuation value is low enough that it is not worth making the interest payment. In this situation, lenders can provide forbearance (capitalize interest payments into loan balances) to motivate borrowers to still extend loans. A sufficiently negative p allows borrowers to defer interest payments above property cash flows, which amounts to giving them a free option on the property.[7]

Borrowers' strategies are to sell, default, or extend, and if they extend, they choose to neglect or maintain the property. Borrowers move second in the period and condition these outcomes on extension and purchase offers. The actions available are thus $a \in \{\text{Extend} \times \{\text{Neglect}, \text{Maintain}\}, \text{Default}, \text{Sale}\} \times p$.

Since returns are homogeneous of degree one in D and N, I normalize payouts by D and express all payouts in terms of the debt yield $n \equiv N/D$.[8] The payouts are as follows:

Table 1: Payouts

Outcome	Borrowers $V_b(n; p, \kappa)$	Lenders $V_l(n)$
Sell	$n/\kappa - (1 + r_m)$	$1 + r_m$
Extend & Maintain	$n - (r_m + p) + \beta(1 - p)E[V_b(n'; a_m)]$	$r_m + p + \beta(1 - p)E[V_l(n'; a_m)]$
Extend & Neglect	$(1 + \nu)n - (r_m + p) + \beta(1 - p)E[V_b(n'; a_n)]$	$r_m + p + \beta(1 - p)E[V_l(n'; a_n)]$
Default	0	$\Lambda n/\underline{\kappa}$

where a_n and a_m denote actions that entail neglect and maintenance occurring, respectively. Expectations are over future NOI, which is assumed to be log-normally distributed. Namely, $n' = \mu(a)Zn$, where Z is log normally distributed with $\mathbb{E}(Z) = 1$, and $\mu(a)$ is either $\mu_m = (1 + g)/(1 - p)$ or $\mu_n = (1 - \theta)\mu_m$, depending on borrowers' maintenance incentives. To simplify notation, denote the integral defining borrowers' and lenders' expected values in the next period as $\mathscr{V}_i(X) \equiv \int_0^\infty V_i(ZX)dF(Z)$ for $i \in \{b, l\}$, then discounted continuation values can be expressed as $\beta(1 - p)\mathscr{V}_i(\mu n)$ for the appropriate $\mu \in \{\mu_m, \mu_n\}$.

[7] Lenders have other options to prevent highly-distressed borrowers from defaulting, such as reducing interest rates or forgiving part of the loan balance. I account for these possibilities in the empirical work, but focus on forbearance in the model because it keeps the payout structure the same (just with the possibility of p going negative).

[8] Note that a value function normalized to D is $V(N/D) = \tilde{V}(D,N)/D$, where $\tilde{V}$ is the pre-normalization value function. This means that paydowns have the effect of creating a normalized continuation value $\tilde{V}(D', N')/D = (D'/D)V(N'/D') = (1 - p)V(n')$.

Note that lenders' value functions omit the potential cost to loss recognition $-\chi(1-\Lambda n/\underline{\kappa})$. I exclude that term so that the payouts are consistent with the functions determining the continuation values from extensions. The cost to loss recognition will be added later as a one period shift in payoffs that does not affect continuation values (if loss recognition is costly in the future, there is little benefit to delaying it).

2.3. Equilibrium

I solve for a Markov perfect equilibrium where lenders select a paydown (p) as a function of the state (n) to maximize the expected recovery from a loan, and borrowers optimally select an action depending on the current state, the required paydown, and sale offer (κ).

Borrowers and lenders choose the strategies and receive expected payouts according to the following Bellman equations:

$$V_b(n) = \mathbb{E}_\kappa \left[\max \left\{ \underbrace{0}_{\text{Default}}, \underbrace{\frac{n}{\kappa} - (1+r_m)}_{\text{Sell}}, \underbrace{n - (r_m + p^*(n)) + \beta(1-p^*(n))\mathscr{V}_b(\mu_m n)}_{\text{Extend-Maintain}}, \right.\right.$$
$$\left.\left. \underbrace{(1+\nu)n - (r_m + p^*(n)) + \beta(1-p^*(n))\mathscr{V}_b(\mu_n n)}_{\text{Extend-Neglect}} \right\} \right] \tag{1}$$

$$V_l(n) = \max_p \{\pi_{\text{sale}}(n,p)(1+r_m) + \pi_{\text{def}}(n,p)\Lambda n/\underline{\kappa}$$
$$+\pi_{\text{ext}}(n,p)\Big(r_m + p + \beta(1-p)\mathscr{V}_l\big(\mu(n,p)n\big)\Big)\Big\}$$

where $\pi_{\text{sale}}(n,p)$, $\pi_{\text{def}}(n,p)$, and $\pi_{\text{ext}}(n,p)$ are the probabilities that the borrower pays off a loan, defaults and extends, respectively. These outcomes are potentially stochastic from the perspective of a lender because they do not know what κ a borrower will draw. These probabilities are derived in Appendix B.1. $p^*(n)$ denotes the optimal pay down coming from lenders' optimization problem, and $\mu(n,p)$ denotes expected NOI growth based on the borrower's optimal maintenance decisions.

The algorithm to solve for the policy functions is outlined in Appendix B.2. Briefly put, the model is solved by guessing the value functions ($\mathscr{V}_b$ and $\mathscr{V}_l$), and then (i) solving for borrowers' optimal action as a function of n, p and κ based on the guess for $\mathscr{V}_b$, (ii) finding the lenders' optimal $p^*(n)$ given borrowers' policies, (iii) updating the value functions based on these best responses, and (iv) iterating until value functions converge.

2.4. *Graphical analysis*

Here I will graphically characterize how equilibrium outcomes in the model are determined. The expressions underlying this analysis are discussed in Appendix B.3.

Starting with the borrower's decision, there are two key functions that determine whether a borrower is willing to accept an extension, and if so, whether they choose to maintain the property after.[9] First, is the maximum paydown that firms are willing to provide on an extension, which I denote D-B(n), since it represents the borrower's default boundary. This curve is upward sloping since higher debt yields entail greater cash flows earned during the extension period and a greater chance that the borrower can profitably sell the property in the future, both of which increase borrowers' willingness to pay down the loan. Second, there is a downward sloping function giving the paydown such that borrowers are indifferent between neglect and maintenance, which I denote M-B(n) since it gives the boundary where borrowers maintain the property if they extend. Paydowns above this line reduce expected future distress enough that borrowers are motivated to maintain the property.

Panel (a) of Figure 1 plots these curves, and shows the associated loan outcomes as a function of n and p. Parameter values are set to match estimates from other literature, as is discussed in Appendix B.4, and are presented in Table A.1. These parameters entail an expected 7.5% discount if forced to sell immediately ($\alpha = 12.3$) and 24% foreclosure costs ($\Lambda = 0.76$), but no cost to loss recognition ($\chi = 0$).

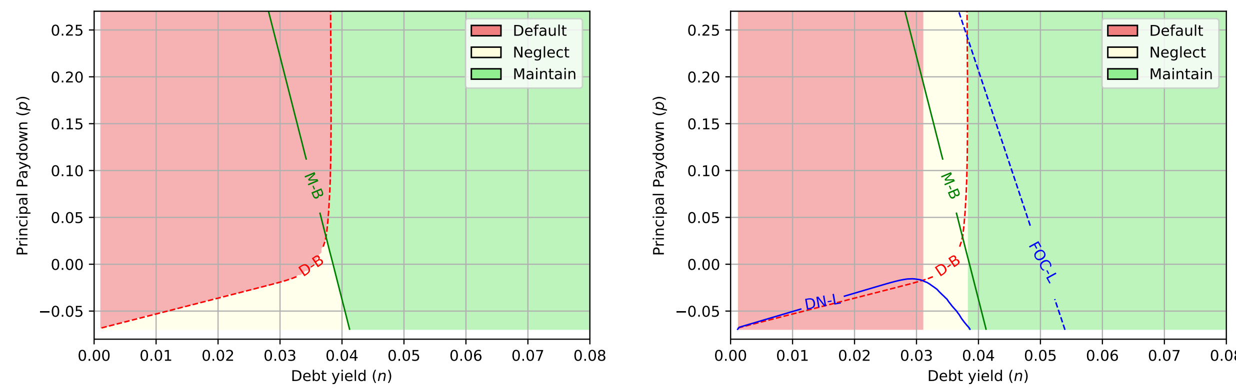
The curves define three regions. Borrowers default when $p >$D-B(n) (the red region). They maintain the property when $p \in [\text{M-B}(n), \text{D-B}(n)]$, meaning paydowns are high enough that borrowers choose to maintain the property, but not so high that they choose to default (the green region). Finally, they neglect the property when $p < \min\{\text{M-B}(n), \text{D-B}(n)\}$, meaning that lenient extension policies prevent default but do not leave borrowers sufficiently committed to the property to maintain it (the yellow region).

Turning to lenders' problem, the regions in panel (a) determine the participation constraints lenders face in setting extension terms. The key functions defining lenders' actions are the minimum paydown lenders are willing to accept to extend a loan (denoted DN-L, since lenders are indifferent between default and neglect) and the optimal paydown for lenders that are not constrained by borrowers' default decisions (denoted FOC-L, since it gives the first order condition associated with the interior solution for p^*).

Panel (b) adds FOC-L and DN-L to the figure. The shaded regions now pertain to outcomes that occur for the equilibrium $p = p^*(n)$ rather then the p on the y-axis. There are four regions defining loan outcomes. At low debt yields, DN-L(n)>D-B(n), meaning that lenders demand a higher paydown than borrowers are willing to provide, leading

[9] For now, I ignore the sale option, so this discussions pertains to how borrowers behave when they either receive a weak offer (high κ) or have a debt yield such that paying off the loan is infeasible at any possible sale offer.

Figure 1: Equilibrium Maturity Outcomes



(a) Borrowers' Indifference Conditions

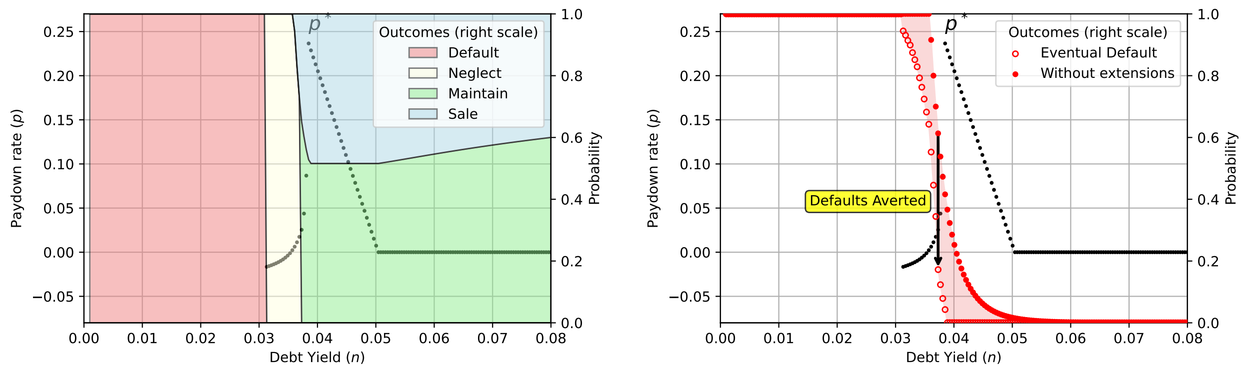
(b) Lenders' Optimality Conditions

Notes: Panel (a) plots the paydowns and debt yields for which borrowers are indifferent between Default and Extend (D-B), and Neglect and Maintain (M-B). Red, yellow, and green regions show where borrowers with a debt yield of n would choose to default, neglect, and maintain, (respectively), given an extension offer of p and a κ draw such that paying off the loan is not optimal. Panel (b) adds DN-L, showing where lenders are indifferent between default and neglect (solid blue line), and FOC-L, showing the optimal p when lenders are not constrained by borrowers' default or maintainance decisions (blue dashed line). The colored regions denote the outcomes at a given debt yield for lenders' optimal paydown rate.

borrowers to default (the red region). At intermediate debt yields, D-B(n)$\in$ [DN-L(n), M-B(n)], meaning that borrowers are willing to make paydowns that are high enough to induce lenders to accept the extensions, but not high enough for them to maintain the property (the yellow region). Just above this range is a sliver of debt yields such that D-B(n)$\in$ [M-B(n), FOC-L(n),], meaning that borrowers will accept a paydown that is enough to address the debt overhang problem, but still less than lenders would desire (the left-most part of the green range. For these last two regions, there is room for a mutually agreeable extension since DN-L(n)<D-B(n), but lenders are constrained by borrowers' default condition. Consequently lenders set the paydown to the highest amount borrowers would accept: $p^*(n) =$ D-B(n). Finally, when D-B(n) >FOC-L(n), borrowers' participation constraint is not binding, so lenders extend loans with $p^*(n) =$ FOC-L(n), balancing the benefit of paydowns reducing risk with the cost of banks earning a spread on a lower balance.

Figure 2 shows observed maturity outcomes by debt yield accounting for the possibility that loans pay off. Panel (a) presents maturity outcomes (the colored regions) and paydown rates (the black dots). It clarifies that there are two distinct debt yield regions in determining extension terms. At low debt yields, lenders are constrained by borrowers' participation constraint, so extensions are determined by how large a paydown borrowers are willing to make. This causes p^* to be an increasing function of n, tracing out the part of the D-B curve that sits above the DN-L curve. At higher debt yields, lenders are not constrained by borrowers' willingness to pay down a loan, so outcomes are determined by the size of a concession that lenders would like to mitigate risks of future property value declines. In this region, p^* declines in n because higher incomes reduce the need for paydowns to mitigate future default risk (p^*

Figure 2: Observed Extension Outcomes



(a) Equilibrium Principal Paydowns

(b) Eventual Loan Performance

Notes: Panel (a) plots equilibrium principal paydowns (black dots, left scale), and the probability that various maturity outcomes occur (colored regions, right scale). Red, yellow, green, and blue regions show the probability that borrowers would choose to default, neglect, maintain, and pay off a loan (respectively), given an extension offer of $p^*(n)$. Panel (b) adds information on ultimate performance; hollow yellow dots show the probability that a loan with a given n eventually defaults, and solid red dots show the probability that a loan would have defaulted if extensions were not available. The red area shows the decline in the probability of eventual default due to extensions.

traces the FOC-L curve).[10]

Panel (b) shows that p^* and n are informative as to future repayment prospects. Hollow red dots show the probability that a loan eventually defaults (potentially after a string of extensions), and solid red dots show the probability that a loan with a given debt yield would default if lenders were unwilling to extend a loan. Extensions reduce the risk of default, but depending on the debt yield and principal pay down, sometimes future default remains highly likely.[11] There is a steep drop in future default risk beyond the point that borrowers become willing to maintain the property and the risk of future default becomes very low once borrowers are no longer limited in their willingness to pay down loans.

In short, even though the future performance of extended loans is not observable in real time, the conditions of the property and the terms of the extension are highly predictive of future repayment prospects. If a loan has either a high debt yield or a meaningful principal paydown, it means that the borrower is committed to the property and the loan is likely to pay off once they are able to get a competitive offer to sell or refinance. Extensions with minimal concessions at lower debt yields are the ones that are unlikely to successfully pay off without a loss in the future. In the baseline calibration with no capital preservation incentives, these extensions are still efficient since the potential to avoid foreclosure costs is enough to compensate for debt overhang costs. However, a byproduct of these actions is still that extensions could mask underlying CRE market strains since banks are extending some loans that would likely default in the future.

[10] I assume that lenders cannot force borrowers to defer interest payments, so p^* is 0 for the high debt yields such that lenders would prefer borrowers to operate with higher loan balances.

[11] The derivation of eventual default probabilities is in Appendix B.1.

2.5. Comparative statics

This section investigates how changes in model parameters affect equilibrium maturity and extension outcomes. Since the primary topic of interest is extend and pretend, I start by showing what happens when the benefit to delaying loss recognition (χ) rises from 0. I then briefly characterize the effects of changing property market liquidity (α), foreclosure costs (Λ) or debt overhang effects (ν and θ) to provide more clarity on the general model mechanisms.

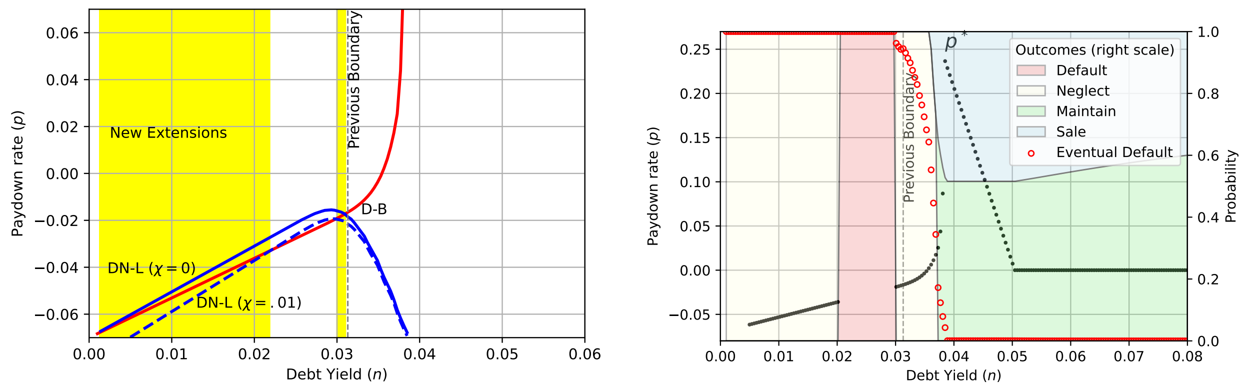
Extend and pretend incentives Figure 3 plots how increasing χ from 0 to 0.01 affects maturity outcomes. The left panel plots the shift in the DN-L curve brought about by the temporary cost to less recognition. The paydown that lenders require to extend loans shifts down since lenders are more motivated to prevent default, even if only temporarily. The downward shift is most pronounced at very low debt yields, since those loans would post the largest losses without an extension. The change to χ creates new extensions in two debt yield regions. First, loans just below the boundary where loans previously started to receive extensions (the vertical dashed line) start getting extended. Without benefits to delaying loss recognition, foreclosure only offered slightly higher expected returns than extension for these loans, so the small additional benefit to extension is enough to induce lenders to extend. These new extensions occur in the right-most yellow region.

The second range of loans affected are those at the bottom of the debt yield distribution. These loans get extended because they would produce the largest losses without an extension, and thus are most affected by the cost to loss recognition. These new, highly-stressed extensions occur in the left-most yellow region. While the baseline model has no role for bank examiners in restricting such extensions from being made, the model could easily be amended by providing a floor to p reflecting examiners' ability to assess whether loans are "restructured with reasonable repayment terms" (Federal Reserve System et al., 2023). Such a change would prevent banks from extending the most severely stressed loans, and restrict extensions more to the loans in the first region.

The right panel adds information on principal paydowns and the eventual probability of repayment. To the right of the dashed line, outcomes are all identical to those of the baseline calibration shown in Figure 2.[12] New extensions start to occur for the low debt yields documented in the left panel. These extensions are associated with negative paydowns (the black dots showing $p^*(n)$ are below 0) and virtually no chance of loans ultimately repaying (the red dots showing the probability of eventual default are near 1). Unlike in the baseline calibration, lenders do not extend loans because the chance of avoiding foreclosure costs is enough to offset debt overhang effects; lenders benefit from delaying default and are willing to extend loans with no real prospect for future repayment.

[12]This is because the terms of stressed extensions are determined by the maximum paydown borrowers will accept. This maximum paydown is unchanged because (i) it is lenders' payoffs that change and (ii) the shift in lenders' willingness to extend loans is temporary and thus doesn't affect borrowers' expectations for future extension policies.

Figure 3: Extend and Pretend Incentives (χ: 0→1%)



(a) Lenders' required paydowns shift down

(b) Low p, n and future repayment for marginal extensions

Notes: The solid blue and red lines in panel (a) show the p such that lenders and borrowers are indifferent between extension and foreclosure, respectively. The dashed blue line shows how lenders' indfifference condition shifts if χ increases to 0.01. The highlighted area demonstrates the range of debt yields that newly receive extensions due to the change in lenders' objective function. Panel (b) provides outcomes at maturity when $\chi = .01$. Red, yellow, green and blue regions represent the probability of default, neglect, maintain, and pay off. Black dots give required pay downs by debt yield (left scale) and red hollow dots the probability that a loan ultimately defaults.

Roles of other frictions While the primary focus of the paper is on extend and pretend, examining how competing motivations for extensions affect observable outcomes is also useful for understanding patterns seen in the data. Figure A.1 presents model outcomes isolating the effects of the three drivers of extensions. Panel (a) shows outcomes with just search frictions, panel (b) outcomes with just foreclosure costs, and panel (c) outcomes with just costs to loss realization. Other parameters, including debt overhang costs, are the same as in the baseline calibration.

These figures show that the various motivations to extend loans affect different debt yield regions. Panel (a) demonstrates that search frictions only cause extensions at high debt yields. When foreclosure costs are removed, lenders have no reason to avoid foreclosure, and thus do not extend loans where borrowers would engage in inefficient maintenance practices after. Panel (b) shows that foreclosure costs cause extensions for debt yields just below the point at which borrowers would be able to pay the loan off. Above this point, loans always payoff (since there are no search frictions), and below it, debt overhang costs outweigh the benefit of giving time for incomes to recover. Finally, panel (c) shows that costs to loss recognition prompt lenders to extend only the most highly-stressed loans, while allowing some closer-to-viable loans to default.[13]

Overall, these results point to a clear distinction between search-related frictions and those related to resolution costs. Search-related extensions go to borrowers that maintain the property, and have either high current debt yields or large paydowns (increasing future debt yields) so that the risk borne by lenders is minimal. In contrast, extensions related to costs of foreclosure or loss recognition tend to entail lower debt yields, low principal repayment, poor maintenance

[13] When all three frictions are removed, no extensions would occur at all; borrowers repay loans if possible and default otherwise.

incentives, and poor future repayment prospects. The primary distinguishing factor is degree, as these issues are all more pronounced for extensions to delay loss recognition; since the motivation is to delay rather than minimize losses, poor future repayment prospects do less to deter extend and pretend behavior.

Regarding the effect of debt overhang, panel (a) of Figure A.2 shows the effects of reducing the amount that borrowers can divert from the property (reducing θ and ν by half). This change increases the range of debt yields over which lenders are willing to provide extensions with the purpose of avoiding foreclosure costs. Panel (b) shows that this reduction in debt overhang effects has a similar effect similar to a 7 percentage point increase in foreclosure costs. Extensions for moderately distressed loans involve lenders trading off the costs of property value declines from debt overhang effects and the benefit of potentially avoiding foreclosure costs, and thus reducing the former has similar effects as increasing the latter.

2.6. Recap and Testable Predictions

These figures provide the foundation for the empirical work in the next section. To summarize the results, if strains related to rapid monetary policy tightening and regional banking turmoil prompted banks to extend and pretend, we would expect to see the following based on Figure 3:

1. More extensions during the stress period
2. Extensions to occur at lower debt yields
3. Extensions to have more lenient terms (less principal repayment)
4. Extended loans to have lower ex-post payoff rates

More generally, the motivation for extensions can be inferred by a combination of the debt yield of the loans getting extended and the terms of those extensions. Extensions to prevent or delay default for income-strained properties go to borrowers with low debt yields and entail minimal borrower concessions since borrowers would default if such concessions were required. In contrast, extensions to deal with property sale or refinancing frictions entail high principal paydowns for low-debt-yield loans, and have a high probability of eventually paying off.

3. DATA AND METHODOLOGY

3.1. Data

I test the four predictions from Section 2.6 using supervisory data that large banks report for their stress tests. FR Y-14Q Schedule H.2 filings provide a loan-quarter level panel on non-owner-occupied CRE loan holdings with committed balances over $1 million from banks with more than $100 billion in assets. I start the sample in 2016q1 since a reporting change after that quarter allows me to identify what happens to loans that exit the balance sheet (e.g., distinguish payoffs from liquidations). The sample runs through 2025q2.

One of key variables of interest is the maturity date, from which I derive whether loans are extended and whether a loan is scheduled to mature. Per the Y-14 reporting instructions "The maturity date is the last date upon which the funds must be repaid, inclusive of extension options that are solely at the borrower's discretion." Consequently, changes in this maturity date reflect extensions provided by lenders, rather than the exercise of existing options.

The empirical methodology and the other variables of interest vary depending on which prediction is being tested, so I will discuss those in turn.

3.2. *Predictions 1 & 2: How many and which loans get extended*

The first two predictions say that greater extend and pretend incentives result in more extensions, and, in particular, more extensions for riskier loans. To test these predictions, I estimate regressions along the lines of:

$$100 \times \text{Extension}_{i,t+1} = (\beta' X_{i,t}) \times \text{2023-on}_t \times \text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t} \tag{2}$$

where $\text{Extension}_{i,t+1}$ is an indicator for whether a loan is extended in the next quarter, $\text{Maturing}_{i,t}$ is an indicator for whether it is scheduled to mature next quarter, and $\tau_{b(i),t}$ is a bank quarter-fixed effect. 2023-on_t takes a value of 1 for quarters starting 2023q1, and 0 for quarters before the pandemic. This period was characterized by high interest rates, weak CRE transaction volumes, rising CRE nonperformance, and increased attention on bank CRE exposures following the Spring 2023 regional banking turmoil. I exclude the onset of COVID from the baseline analysis so the stress period is compared to a relatively normal environment, rather one with elevated extensions due to the pandemic-era disruptions. See Glancy et al. (2025) for a description of CRE modification patterns early in the pandemic.

When $X_{i,t}$ only includes an intercept, β estimates how the probability that a maturing loan is extended changes during the stress period, thus testing the prediction that extensions rose during at that time. $\text{Lower Level Controls}_{i,t}$ includes the non-interacted variables, and thus γ can also provide an estimate for the change in extension frequencies for loans without pending maturities (from the coefficient on 2023-on_t in specifications that omit time-fixed effects).

When $X_{i,t}$ is expanded to include various risk characteristics, the regression tests the second hypothesis; namely, that riskier loans got extended during the stress period. In this analysis, $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, or is secured by a small- or large-sized office (defined by a square footage under or over 250,000).[14] β estimates the extent to which loans with these risk factors were disproportionately extended at

[14] Debt yield may be uninformative if NOI is missing or hasn't been updated in the last year, or if repayment relies on the successful execution of a construction or renovation plan rather than in place cash flows (i.e., for nonstabilized loans). In these circumstances, I mark $\text{Low Debt Yield}_{i,t}$ to

maturity during the stress period. The prediction that extend and pretend incentives cause extensions to increase for low debt yield loans comes directly from the model. The remaining variables in $X_{i,t}$ reflect other risk factors would likely have similar effects to low debt yields; nonrecourse clauses remove lenders' claim on borrowers' other assets and may thus reduce foreclosure recoveries (Glancy et al., 2023), and office loans have poor NOI growth prospects due to the shift to work from home (Gupta et al., 2022; Glancy and Wang, 2023). These latter effects are particularly pronounced for larger offices, motivating the decision to segment offices by size (Glancy and Kurtzman, 2024).

I also conduct several variants of this type of analysis. This work includes (i) examining other loan outcomes (default or payoff) besides extensions, (ii) examining differences in extension rates quarter-by-quarter rather than pooling stress and non-stress periods, (iii) analyzing pending maturities over a one year horizon to account for loans that pay off or get extended before their quarter of maturity, and (iv) estimating the probability that loans are extended as a flexible function of debt yield rather than using the low debt yield indicator.

3.3. Prediction 3: Terms of extensions

To test the prediction that extend and pretend incentives cause banks to ease terms (accept lower principal repayment) on extended loans, I estimate:

$$100 \times \Delta \text{Term}_{i,t} = (\beta' X_{i,t-1}) \times \text{2023-on}_t \times \text{Extension}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t} \quad (3)$$

where $\Delta\text{Term}_{i,t}$ reflects the change in principal balance, loan rate spreads or recourse status of a loan. Lower Level Controls$_{i,t}$ includes lower level interactions of the variables of interest, as well as a vector of variables related to changes in loan terms that might occur without extensions. These include controls for the loans' age, size, scheduled amortization, and previous spread.[15]

In the baseline analysis, $X_{i,t-1}$ only includes a constant, so β measures how much more often a given term was incorporated into extensions relative to before the pandemic. The coefficient on Extension$_{i,t}$ (included in γ), measures the baseline increase in frequency with which a term is changed for extended loans relative to similar non-extended loans, thus distinguishing the effect of extensions from changes in terms that occur for other reasons. When $X_{i,t-1}$ is expanded to include the risk factors discussed in Section 3.2, β measures whether banks tightened or eased terms on extensions during the stress period for riskier loans in particular. Risk factors are measured as of the quarter before the

0 and include an indicator to denote the omitted debt yield.

[15]Size is the logarithm of the previous loan balance. Controls for scheduled amortization include both the scheduled payment as a share of the previous loan balance based on the reported amortization schedule and the realized amortization in the previous quarter. I include the latter due to some apparent reporting errors with scheduled amortization causing lagged principal repayment to be more predictive of future repayment. To reduce the influence of reporting errors or outliers, missing or extreme values for spread or amortization variables are set to 0, and dummies for whether values are missing, high outliers or low outliers are included. Most CRE loans have minimal amortization, so results are not sensitive to the controls.

extension so that $X_{i,t-1}$ does not reflect changes that were a part of the extension (e.g., a debt yield that is high due to a principal pay down).

3.4. Prediction 4: Ex-post performance of extended loans

To test whether stress-era extensions performed worse than other loans, I estimate

$$100 \times \text{Paid Off}_{i,t+1} = \beta_1 \text{Extended}_{i,t} + \beta_2 \text{2023-on Extension}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t} \tag{4}$$

where the dependent variable is an indicator for whether the loan pays off next quarter, $\text{Extended}_{i,t}$ is an indicator for whether the loan was previously extended, and $\text{2023-On Extension}_{i,t}$ is a indicator if the loan was extended during the stress period. $\alpha_{m(i),t}$ is a fixed effect for the number of quarters to maturity, which accounts for the fact that extension terms are typically shorter than that of new loans. $\tau_{b(i),t}$ is a bank-quarter fixed effect, which accounts for broad changes in the probability of repayment over time.

β_1 captures differences in payoffs between prepandemic extensions and other loans at the same bank and quarter, controlling for time to maturity. β_2 captures how payoff rates differ for stress-era extensions relative prepandemic ones. If banks extend loans during the stress period because they want to delay loss recognition rather than because they expect modifications to enhance future repayment prospects, β_2 would be negative.

3.5. Differences by bank capitalization

The last piece of analysis investigates differences in extension frequencies and terms across lenders with different capitalization levels. This analysis tests whether banks that are closer to a capital requirement extend more loans, extend riskier loans, or provide more lenient terms on extensions. Such behavior would suggest that capital constraints induce some banks to delay loss recognition in order to preserve capital.

For this analysis, I supplement the data on CRE loans with information on bank capital ratios from Y-9C, and on stress test outcomes from public disclosures by the Federal Reserve Board. How stress tests were incorporated into capital requirements changed between the prepandemic and stress periods. Before the pandemic, stress tests were pass/fail based on banks' estimated capital in a "severely adverse scenario." For these years, I measure distance to capital constraints by the minimum common equity tier 1 capital (CET1) ratio in the stress tests. This variable reflects how much headroom a bank had in passing their stress tests.

During the stress period, stress test results translated into capital requirements through a stress capital buffer. For this period, I measure distance to a capital constraint as the difference between a bank's CET1 capital ratio reported in their Y-9C, and their capital requirement inclusive of the bank-specific G-SIB surcharge and stress capital buffer.

I then repeat analysis along the lines of that in Equations (2), (3) and (4), but with $X_{i,t}$ including an indicator for whether the banks' capital buffer is below the median for the quarter (Low Capitalized$_{b(i),t} = 1$). For analysis investigating changes in extension frequencies or terms by risk characteristics, $X_{i,t}$ includes this capitalization measure interacted with the aforementioned risk characteristics.

3.6. Summary statistics

Summary statistics of the main variables of interest are shown in Table A.2, and summary statistics for selected subsamples (prepandemic observations, 2023-on observations, maturing loans, and extended loans) are shown in Table A.3. The tables show that extension rates are modest overall (3% per quarter), but high for maturing loans (53%). Loan terms are fairly stable over the life of CRE loans, but change much more frequently in quarters of extension. For example, the probability of the principal balance declining by at least 5% is 7% for loans receiving extensions, but around 1% for the sample as a whole. Likewise, loans receiving extensions are about 5 times more likely to have their committed balance rise or their spread or recourse status change.

4. DO BANKS EXTEND AND PRETEND?

This section examines the four testable predictions from Section 2.6 regarding how extend and pretend behavior would affect extension patterns. Section 4.1 shows that banks did not materially increase the frequency of extensions in the stress period. Section 4.2 shows that extensions shifted towards *safer* borrowers. Section 4.3 shows that terms of extensions became stricter. Section 4.4 shows that stress-era extensions paid off at similar rates to prepandemic extensions. Finally, Section 4.5 shows that these patterns do not differ materially by bank capitalization.

4.1. Did banks increase extensions?

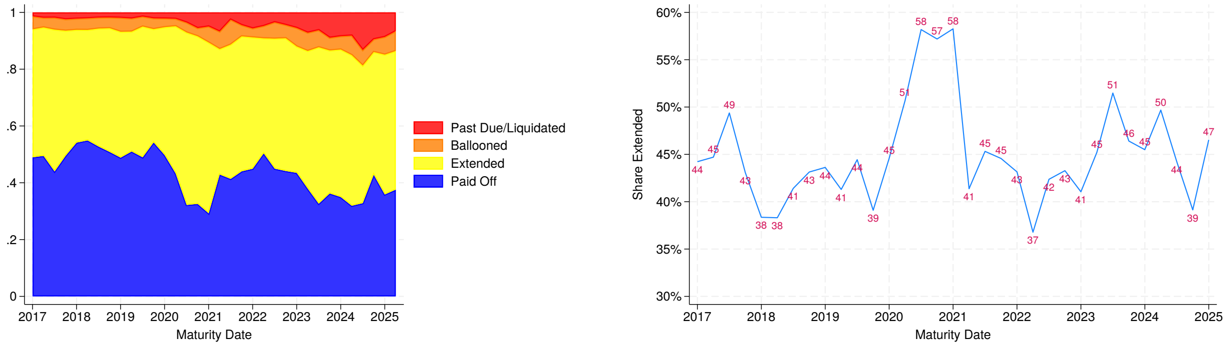
The first testable prediction is that extend and pretend incentives prompt banks to extend loans they wouldn't otherwise, causing more extensions to occur. If fair value declines of banks' fixed rate assets or increased scrutiny of CRE exposures following the 2023 regional banking turmoil prompted banks to extend loans to obscure pending loan losses, we would expect to see more maturity extensions starting in 2023.

To examine how extension frequencies have changed over time, I study outcomes of loans that are slated to mature in four quarters, and assess loan outcomes as of the original quarter of maturity. The outcomes considered are:

1. Paid off: If the loan is disposed of in the following year, and the disposition code indicates a voluntary pay off. I also include a small number of loans that were sold without a charge-off.

2. Extension: If the loan is current and on the balance sheet at the end of the quarter of maturity, but the maturity

Figure 4: Outcomes of Pending CRE Loan Maturities



(a) Maturity Outcomes

(b) Extension Rate over Time

Notes: The left figure shows the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. Sample is composed of loans that are four quarters from the scheduled maturity. The right panel shows the share of balances that are extended, corresponding to the yellow region in the left chart.

date was extended into the future.

3. Ballooned: If the loan is not past due on interest payments, but the reporting date is after the current maturity date.

4. Delinquent: If the loan is past due in the quarter of maturity, or is marked as liquidated, involuntarily paid off or sold at a loss by that point.

Figure A.3 shows that the occurrence of these outcomes rises slightly in the year before maturity, and then jumps in the actual quarter of maturity. Consequently, the one year window I consider should capture most extensions, payoffs, and delinquency associated with a pending loan maturity.

Figure 4 plots the composition of outcomes for loans with a pending maturity (left) and the share of pending maturities that get extended (right) by quarter of maturity. The figure shows that extension volumes rose during the stress period, but not dramatically so. The volume of maturing loans receiving extensions was a bit under 50% for most of 2023 and 2024, compared to shares that were typically in the mid-to-low-40s before the pandemic. The share of loans paying off at maturity (the blue area in the left figure), fell from near one half before, to one third during the pandemic, but this was mostly attributable to more loans missing payments rather than more loans receiving extensions. The extension share was highest in the year following the onset of the pandemic at just under 60%.

The appendix presents similar analysis at a more disaggregated level. Figures A.4 and A.5 distinguish stabilized vs. non-stabilized (construction and renovation) loans and offices vs. other property types, respectively. The results show that outcomes of loan maturities were broadly similar for stabilized and non-stabilized CRE loans. Across property types, office loans became much less likely to pay off at maturity—only about 20% of office loan balances paid off during the period of stress, compared to over 40% before the pandemic—however, this change mostly reflected a higher rate of default rather than an increase in extensions.

There is also little evidence of extensions increasing during the period of stress when the analysis is expanded to include loans without pending maturities. The first column of Table A.4 presents estimates from equation (2), excluding the interactions with risk characteristics and the bank-quarter fixed effect (so that 2023-on$_t$ is identified). It shows that on an unweighted basis, maturing loans were about 4 percentage points less likely to be extended during the period of stress and non-maturing loans were about half a percentage point less likely to get extended.[16] The fourth column analyzes defaults instead of maturity, and shows that the decline in extensions is mostly accounted for by a higher share of loans being delinquent at maturity.

Overall, these aggregate patterns demonstrate that there was stress in the market prompting more loans to default upon maturity. However, there is no clear sign of banks increasing extensions to hide the stress. Extension rates were roughly in line with historical norms, and the area of most pronounced stress (office loans) saw delinquency rise rather than extensions. These patterns are more consistent with the effects of a decline in valuations—which shifts more mass into the default region—than an increase in banks' willingness to accept extensions to avert default.

Another implication of the fact that recent extension rates are in line with historical norms is that the pending "Wall of Maturities" is also not historically atypical. One frequently cited concern about recent CRE loan extensions is that it creates a build-up of near term maturities that will strain loan performance going forward (Crosignani and Prazad, 2024). While it is true that recent extensions add to pending maturities, this situation has been the norm for the entire history of the Y-14 data collection. Figure A.6 plots the share of outstanding CRE loans scheduled to mature in the next two years, and the share of those loans accounted for by recently extended loans. The share of loans maturing in the next two years has grown since the onset of the pandemic, but it remains within its prepandemic range and the contribution from recent extensions is slightly less than normal.

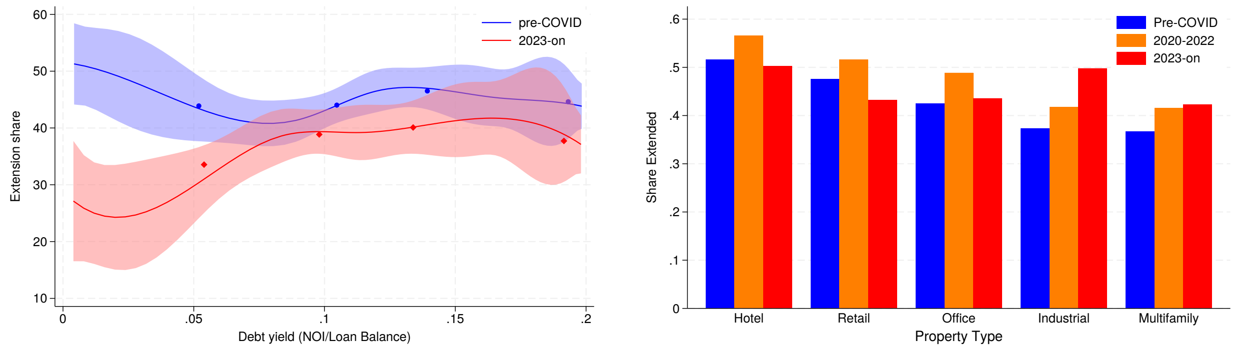
4.2. Did extensions rise for riskier loans?

The second testable prediction I investigate is that extend and pretend incentives cause banks to extend lower-quality loans. In the context of the model, the marginal extensions driven by capital preservation incentives occur at very low debt yields, since those loans would produce larger losses in default. However, other factors that reduce property valuations (e.g., office strains) or recovery prospects (e.g., nonrecourse clauses) also increase potential losses and thus would have similar effects to low debt yields.

Contrary to this prediction, Figure 5 demonstrates that extension rates declined for low debt yield properties during

[16]The decomposition in Figure 4 code loans as delinquent when they were both extended and delinquent. In regressions, I count these loans as being extended since I am not trying to decompose loan outcomes.

Figure 5: Maturity Extensions by Risk Characteristics



(a) Extensions by Debt Yield

(b) Extensions by Property Type

Notes: The left panel presents semi-linear regression estimates of the probability of extension as a function of a loan's debt yield and bank-quarter fixed effects. Estimates come from a cubic B-spline, restricted to have a continuous second derivative, using the binsreg package of Cattaneo et al. (2024). Dots provide binscatter estimates by quartile. Sample includes stabilized loans with recent NOI updates that are scheduled to mature in four quarters. Estimates for loans slated to mature before the pandemic are in blue and during the stress period in red. The right panel plots the share of loans with pending maturities that get extended by property type. Blue, orange, and red bars give extension rates before, during and after the pandemic, respectively.

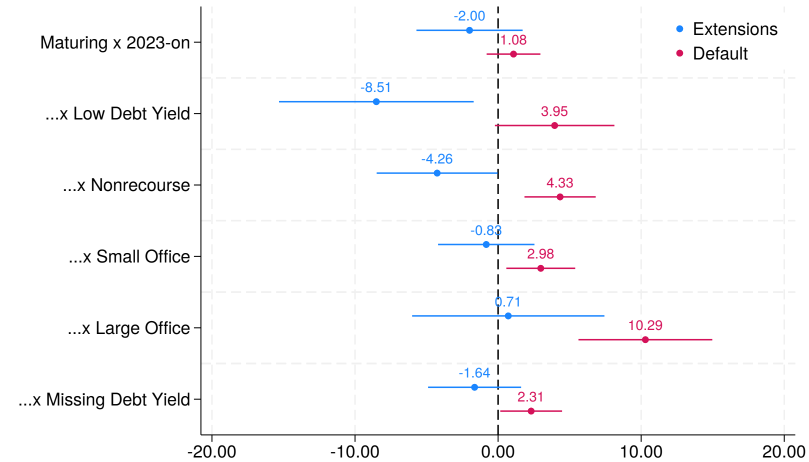
the stress period and only rose for better-performing property types. The left figure presents cubic spline regression estimates predicting whether loans maturing in the next year receive an extension. Before the pandemic, extension rates were roughly flat across debt yields (the blue line). After 2023, extension rates start to decline after debt yields fall under 8%.

The right panel plots the share of pending CRE loan maturities that receive extensions by property type before COVID (blue bars), from 2020 to 2022 (orange bars), and during the period of stress (red bars). This figure demonstrates that extensions only materially rose for industrial and multifamily properties—the property types that fared best coming out of the pandemic. Extension rates for the riskier hotel, retail and office sectors either fell or stayed near prepandemic rates.

Figure 6 presents estimates more formally testing how banks' tendency to extend risky loans changed starting in 2023. Blue dots (lines) plot point estimates (95% confidence intervals) from equation (2), while red dots show equivalent estimates predicting whether loans are delinquent in the following quarter. The figure plots estimates of the β vector, reflecting how much banks changed their tendency to extend risky loans upon maturity. Other coefficient estimates, for example those pertaining to extensions of maturing loans before the period of stress or changes in extensions for non-maturing loans, are shown in Table A.4.

Overall, the figure validates the idea that banks reduced maturity extensions for riskier loans. Low debt yield loans were about 9 percentage points less likely to receive extensions during the period of stress, nonrecourse loans (where banks cannot recover deficiencies from borrowers' outside assets) were 4 percentage points less likely to get extended,

Figure 6: Maturity Extensions by Risk Characteristics, Regression Estimates



Notes: Figure presents estimates of β from the specification

$$100 \times \text{Extension}_{i,t+1} = (\beta' X_{i,t}) \times \text{2023-on}_t \times \text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where $\tau_{b(i),t}$ is a bank quarter fixed effect. Blue dots (lines) present point estimates (95% confidence intervals) for how much particular risk factors increased the probability that maturing loans received extensions during the period of stress. Red dots (lines) present equivalent estimates of the probability that loans are delinquent as of maturity. Estimates correspond to columns (3) and (6) from Table A.4.

and office loans were extended at similar rates to before the period of stress. The red dots show that these risk factors are all indeed associated with higher maturity default risk.

Though banks reduced extensions of risky loans with pending maturities, there is some evidence of banks increasing extensions for riskier non-maturing loans. Column (3) of Table A.4 shows that extension rates for small and large office loans without pending maturities rose 0.3 and 1.5 percentage points, respectively, starting in 2023. There was no significant difference in non-maturity extension rates by recourse status or debt yield.

To summarize the aggregate evidence, banks frequently extended CRE loans at maturity during the stress period. However, this behavior appears to mostly reflect banks' normal mode of operating rather than a response to the stress itself. Maturity extension rates differed little between the stress period and the prepandemic period, a time characterized by strong bank CRE performance and rising property values. In the cross-section, maturity extension rates stayed the same or declined somewhat for loans with weak incomes (low debt yields) or weak future income prospects (offices). These patterns are generally more consistent with income strains causing borrowers to no longer be willing to support payments and defaulting, rather than banks offering lenient extension polices to prevent highly-stressed borrowers from defaulting.

The one result potentially consistent with extend and pretend behavior is that banks increased extensions of nonmaturing office loans. Whether these office extensions contain provisions that bolster future performance prospects is therefore of particular interest. In the next section I will pay additional attention to office loans when assessing the terms of extensions.

4.3. Did banks ease terms on extensions?

Next, I shift attention to characterizing the terms of extensions. One of the defining characteristics of evergreening/zombie lending is that lenders provide subsidized credit to induce firms to continue operating when they wouldn't otherwise be financially viable. In the model, this materializes as a reduction in required payments that, in essence, provides borrowers with a cheap option on the property. First, I examine how extension terms changed on average during the stress period, then I examine differences by borrower risk.

Extension terms, on average Table 2 presents estimates from Equation (3). The first column predicts the percentage quarterly decline in loan balances by whether or not the loan receives an extension. Extensions during the period of stress, on average, had about 2.7% more of the loan balance paid off upon the extension of a loan. Columns 2 and 3 show that the higher pay down rate reflects both more extensions requiring paydowns and fewer loans with balances rising. CRE loan extensions in the period of stress were about 5.5 percentage points more likely to entail paydowns exceeding 5% of the loan balance relative to before the pandemic, and were about 6.7 percentage points less likely to have balances increase (potentially reflecting interest deferrals).

Additionally, column 4 shows that extensions during the period of stress were 1.4 percentage points more likely to switch to having recourse, though the effect is statistically insignificant. As recourse provides banks an additional means of recovery beyond the subject property, this change has a similar effect on a loan's future repayment prospects as decreasing the loan balance (Glancy et al., 2023).

The last three columns investigate changes in loan pricing. On average, banks increase spreads on extended loans by about 9 basis points more during the stress period compared to before the pandemic. This effect is driven by banks becoming both more likely to increase spreads (column 6) and less likely to reduce them (column 7).

Overall, these findings all point in the same direction, namely that the terms on extensions became more stringent. During the period of CRE market turmoil, borrowers had to pay down more debt and pay higher interest rates to continue receiving credit. While this doesn't necessarily rule out credit being subsidized seeing as fundamental risks to the CRE market rose, it indicates that the motivation for extensions is not merely to delay losses. The model demonstrates that property strains only cause terms to become more stringent in the region where extensions remedy search frictions, not where subsidized credit is needed to keep borrowers from defaulting. That banks amended loan terms in ways that improved the prospect for future recoveries and compensated them for the risks they were taking—and the fact that borrowers were willing to accept these terms without defaulting—are positive signals as to the viability

Table 2: Terms of Extensions

	Pay down	$\mathbb{1}$(Pay down $>5\%$)	ΔBalance>0	Gained Recourse	ΔSpread	$\mathbb{1}(\Delta$Spread $>0)$	$\mathbb{1}(\Delta$Spread $<0)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Extension$_{i,t}$	-2.06**	3.16**	10.96**	2.21**	-0.03**	5.26**	12.13**
	(0.24)	(0.33)	(0.87)	(0.56)	(0.00)	(0.38)	(0.65)
...$\times$2023-on$_t$	2.72**	5.50**	-6.66**	1.40$^+$	0.09**	10.41**	-7.57**
	(0.28)	(0.54)	(1.04)	(0.81)	(0.01)	(1.06)	(0.86)
R^2_a	0.055	0.069	0.135	0.172	0.109	0.293	0.188
Observations	1,244,405	1,244,405	1,244,405	473,257	651,273	651,273	651,273
Controls	✓	✓	✓	✓	✓	✓	✓
Bank-quarter FE?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = (\beta_1 + \beta_2 \text{2023-on}_t)\text{Extension}_{i,t} + \gamma' \text{Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. This variable is the principal paid down as a share of the loan balance in column (1), an indicator for whether this pay down is at least 5% in (2), an indicator for whether the committed balance rose in column (3), and indicator for whether a previously nonrecourse loan became recourse in (4), the change in loan spread in (5) and indicators for whether the spread rose or fell in columns (6) and (7), respectively. The sample changes throughout the analysis: (1)–(3) exclude loans with changes in utilization or charge-offs, (4) requires the loan to previously be nonrecourse, and (5)–(7) require loans to have floating rates. The main independent variables are indicators for whether the loan is extended in quarter t and its interaction with an indicator for whether t occurs during the period of CRE stress (2023-on). All specifications include controls for a loan's age, size, amortization, and previous spread; and bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

of these extended loans eventually paying off.

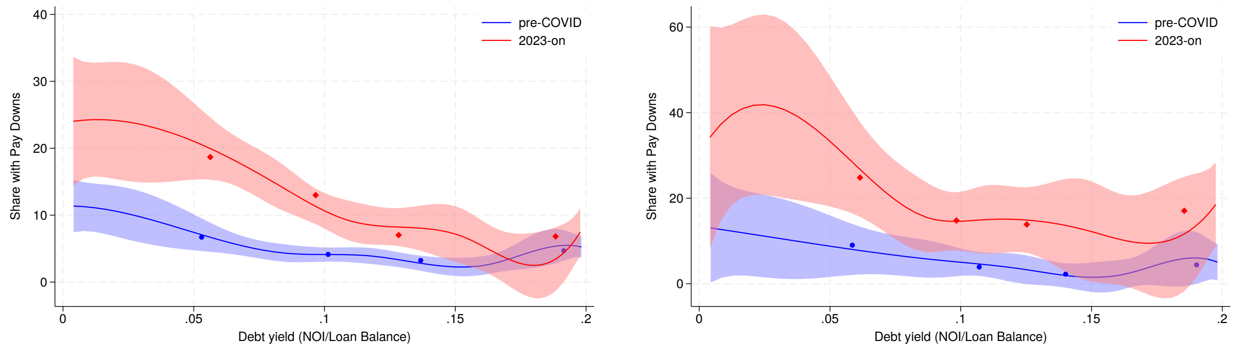
Paydowns By loan risk How do these extension terms vary by loan risk? The model demonstrates extension terms are determined in different ways throughout the debt yield distribution. Strains in the CRE market could conceptually cause terms to tighten for better performing properties (since banks would demand more credit enhancements from borrowers that are willing to provide them) but ease for weaker properties (since borrowers require more drastic accommodation to prevent them from defaulting).

The question is whether banks are willing to provide the extensions that require subsidized credit. If banks restrict extensions to loans that are likely to ultimately pay off—lending to customers that are committed to the property but unable to sell or refinance—then CRE market strains would cause extension terms to tighten, particularly for stressed loans. If instead banks are willing to extend and pretend, we'd see easier terms for more-stressed properties to prevent default. For this analysis, I focus predominantly on whether or not extensions entailed the repayment of at least 5% of the principal since that change most clearly improves banks' prospects for future repayment.[17]

Figure 7 presents spline estimates of the share of CRE loan extensions that entailed a principal paydown of at least 5% during the stress period (red) and before the pandemic (blue). The left panel presents findings for all property types,

[17] Higher spreads don't increase the likelihood that loans pay off, just increase the compensation that banks receive for taking on that default risk. Increases in balances are also somewhat harder to interpret than paydowns since they could reflect interest deferrals (which increase leverage) or the funding property of improvements to enhance collateral values (reducing leverage).

Figure 7: Paydowns by Debt Yield



(a) All Extensions

(b) Office Loan Extensions

Notes: The left panel presents semi-linear regression estimate of the probability an extension entails a principal paydown of at least 5% as a function of a loan's debt yield, controlling for amortization and bank-quarter fixed effects. Estimates come from a cubic B-spline, restricted to have a continuous second derivative, using the binsreg package of Cattaneo et al. (2024). Dots provide binscatter estimates by quartile. Sample includes loan extensions with recent NOI updates. Estimates for pandemic-era extensions are in blue and stress-era extensions in red. The right panel presents the same estimates, but with the sample restricted to extensions of office loans.

and the right restricts the sample to office loans.

The figure demonstrates that principal paydowns became more likely for low-debt-yield loans during the stress period. For the full sample, about 20% of loan extensions in the bottom quartile of the debt yield distribution had material principal paydowns during the stress period, compared to under 10% of extensions before the pandemic. The frequency of paydowns at the top of the debt yield distribution are lower (around 5%), and differ little across the two time periods. The pick-up in principal paydowns for low-debt-yield loans is even more stark in the office sample, with roughly 30–40% of low-debt-yield office loan extensions entailing sizable paydowns, double the prepandemic rate.

To recap, the model demonstrates that extend and pretend incentives prompt lenders to provide lenient extension terms to low-debt-yield borrowers to induce borrowers to extend rather than default (Figure 3). However, in the data, we see that banks reduce extensions to low-debt-yield borrowers and are more likely to require them to pay down their loan (Figures 5 and 7, respectively). That principal repayment decreases in debt yield even at low debt yields indicates that banks predominantly extend loans for which borrowers are committed to the property and willing to provide credit enhancements to retain it.[18] When low-debt-yield borrowers are not willing to provide such enhancements, banks appear comfortable allowing them to default, as evidenced by the decline in extensions and rise in maturity defaults for low-debt-yield loans in Figure 6.

[18]Note that not all potential credit enhancements are observed in the data. Extensions might also include contributions to reserves for capital expenditure, leasing costs, or other future expenses, which would have similar effects to principal curtailment. Likewise, additional guarantees, covenants, or cash sweep or lockbox provisions can enhance a lenders' repayment prospects or control rights. Namely, loans that do not receive principal paydowns may receive other unobserved enhancements.

Robustness to other risk factors and loan terms Patterns are broadly similar for other risk factors (besides low debt yields) and other extension terms (besides principal paydowns). Figure 8 extends the analysis to consider other risk factors. Each dot presents coefficient estimates for β from the specification in Equation (3), corresponding to how much a particular risk characteristic shifted the probability that an extended loan received a paydown during the period of stress.

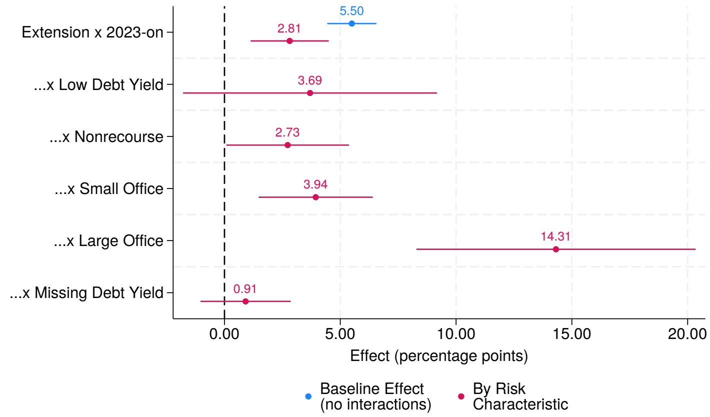
The results demonstrate that paydowns for riskier loans increased during the period of CRE market stress, both overall and relative to extensions for safer loans. The blue dot repeats the second column of Table 2, showing that extensions during normal times were 5.5 percentage points more likely to have a 5% paydown compared to prepandemic extensions. The red dots present the triple-interaction coefficients from Equation (3) when $X_{i,t-1}$ is expanded to include risk characteristics. These results show that the increase in principal paydowns for extensions is most pronounced for riskier loans. A low debt yield increases the probability of a principal paydown by 3.7 percentage points more during the period of stress. Likewise, nonrecourse loans, small office loans, and large office loans were 2.7, 3.9 and 14.3 percentage points more likely to have paydowns during the period of stress, respectively, compared to before the pandemic.

Table A.5 presents results for other loan terms, as well as providing estimates for other coefficients that are not displayed in Figure 8 (e.g., the prevalence with which terms change for extensions during normal times). These results show low debt yields also increased paydowns for extension by about 4 percentage points during the prepandemic period, meaning that low debt yields increased the probability that stress-era extensions have paydowns by nearly 8 percentage points overall (summing the effect of extensions during normal times and the change during the period of stress). The other risk factors appear to have mattered little before the pandemic.

Regarding other extension terms, office loan extensions were more likely to entail the addition of recourse and higher spreads during the stress period, but low-debt-yield loans were less likely to have spreads rise. This may reflect banks' concern about low-debt-yield borrowers being able to service their debt at higher spreads when reference rates were typically much higher than at origination.

In short, the analysis of loan terms shows that banks required greater concessions from borrowers in order to provide extensions during the stress period. Moreover, the increased concessions were most pronounced for riskier loans. This tightening in terms indicates that banks did not need to provide lenient extension policies to prevent borrowers from defaulting as would be emblematic of extend and pretend modifications. The tightening in terms was most pronounced for office loans, indicating that the increase in extensions for nonmaturing office loans discussed in Section 4.2 is not the result of subsidized credit from banks that are unwilling to recognize losses.

Figure 8: Paydowns by Risk Characteristic



Notes: The figure presents β estimates from equation (3), pertaining changes in the frequency with which extensions have paydowns of at least 5% during the stress period. The blue dot presents the estimated coefficient on Extension$_{i,t}$ $\times$2023-on$_t$ in the specification without the risk interactions, while the red dots present estimates of the β vector from the fully-interacted specification. Lines present 95% confidence intervals based on standard errors that are clustered at the bank-quarter level.

4.4. *Were extended loans less likely to ultimately pay off?*

Unlike extensions to address foreclosure costs or search frictions, extensions to delay loss recognition can be desirable from a bank's perspective even if the probability of future repayment is negligible. Indeed, Figure 3 shows that the extensions induced by costs to loss recognition have almost no hope of paying off. This section tests whether future payoff rates for stress-era extensions deteriorated.

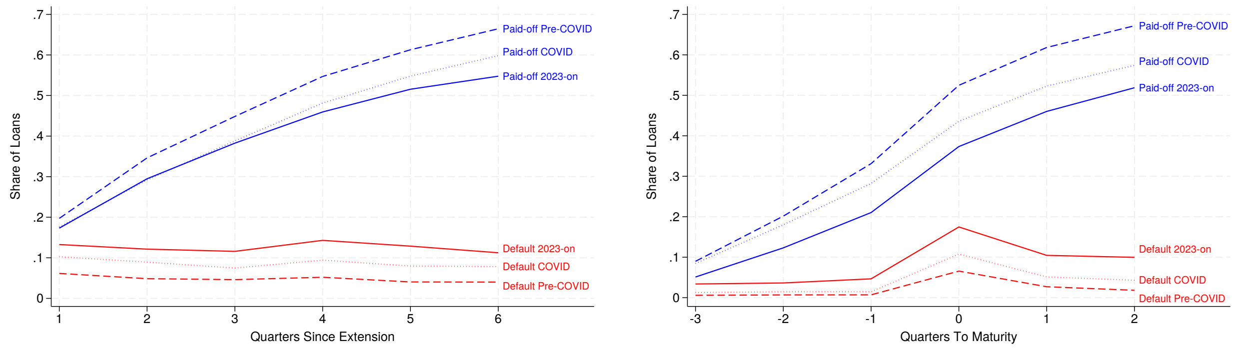
Figure 9 compares the performance of extended loans to that of other loans with pending maturities that had not been previously extended. The left panel plots the share extended loan balances that have paid off over time since the extension. Dashed, dotted, and solid blues show payoff rates for loans extended before, during, and after COVID, respectively. I restrict the sample for this analysis to extensions where the time to the extended maturity is within 6 quarters to ensure the loan comes due by the end of the observation period.[19]

The figure demonstrates that stress-era extensions were less likely to pay off following the extension. 66% of pre-COVID extensions paid off within 6 quarters of the extension, compared to only 55% of loans that were extended during the period of stress. Performance of COVID-era extensions was about halfway in-between these numbers.

The red lines similarly plot the share of extended loans that are delinquent/liquidated over time. Loans extended during the period of stress are more likely to be delinquent following the extension, but extensions appear to not do much to delay the reporting of default; about 13% of loans are delinquent in the quarter after the extension, and this delinquent share, if anything, edges down over the next year and a half.

[19]Payoff horizons are truncated by the 2025q2 sample end (e.g., 2025q1 extensions only contribute to the one quarter horizon payoff rate).

Figure 9: Payoff Rates Over Time



(a) Extended Loans (b) Other Maturing Loans

Notes: Blue lines plot the share of loan balances that pay off over time before (dashed), during (dotted) and after (solid) the pandemic. Red lines plot the share of loan balances that are delinquent or liquidated at that time. The left panel plots performance for loans that were extended by the number of quarters since extension, while the right plots performance for non-extended loans by the number of quarters to maturity.

The key question is whether loan performance deteriorated because lenders started extending lower quality loans, or because stresses in the market caused performance to deteriorate more broadly (e.g., worse property market liquidity reducing payoffs for extended and non-extended loans alike). To get at this effect, the right panel plots the payoff rates for loans with pending (four quarter ahead) maturities that had not been previously extended. These loans would not be subject the selection effects induced by extension decisions and give a comparison group for how performance would differ over time absent such selection effects.

The deterioration in loan payoffs during the stress period is slightly more pronounced for non-extended loans. The share of non-extended loans paying off after 6 quarters declined by 15 percentage points relative to before the pandemic (67% to 52%), compared to 11 percentage points for extended loans. In fact, the 6-quarter-ahead payoff rate for stress-era extensions is slightly above that of non-extended loans (55% vs. 52%).

In short, Figure 9 shows that extended loans are usually a bit less likely to pay off than other loans, consistent with extensions reflecting some underlying repayment difficulty. However, this gap shrank rather than widened during the period of stress. This result is consistent with the other findings about banks becoming more selective with extensions and requiring greater principal paydowns to support future repayment prospects. Namely, more stringent extension policies appear to have bolstered the performance of extended loans during a period of broad repayment difficulties.

Table A.6 presents regression estimates along the same lines of that in Figure 9. Each regression predicts whether a loan pays off in the following quarter based on whether the loan was previously extended, and if so, whether the last extension occurred in 2023 or later. Each specification includes quarter-to-maturity fixed effects to account for differences in loan terms for extensions vs. new originations. The table shows that stress-era extensions are about 4 percentage points less likely to payoff than other extended loans in the specification without quarter fixed effects (column 1). However, the effect goes away when quarter or bank-quarter fixed effects are added in columns (2) and (3). Namely, once the broad deterioration in loan payoffs during the stress period is accounted for, stress-era extensions pay off at a similar rate to prepandemic extensions. While these regressions no longer show that loans that were extended during the period of stress outperform other loans during the stress period, they affirm that such loans performed at least as well prepandemic extensions.[20]

4.5. Did worse capitalized banks have easier extension policies?

Overall, the aggregate evidence is inconsistent with extend and pretend incentives during the stress period driving banks to provide loans to borrowers with weak repayment prospects. Extension rates changed little during the stress period and actually declined for riskier loans. Furthermore, the extensions that occurred during the stress period tended to have more stringent paydown requirements and performed favorably relative to prepandemic extensions. While these findings all suggest that extend and pretend was small in aggregate, it does not rule out those incentives affecting behavior at some banks. In this last section, I examine whether extension patterns at banks near their capital constraints are more consistent with extend and pretend behavior.

Extension policies by bank capitalization To investigate how extension policies differ by bank capitalization, I reestimate equations (2), (3), and (4), but add an additional interaction with Low Capital$_{b(i),t}$, which takes a value of 1 if a bank is closer to their capital buffer than the median for a given quarter.

Table A.7 demonstrates that low capital banks reduced extensions during the period of stress even more than banks that were comfortably above their capital requirements. Well-capitalized banks reduced extension rates for maturing loans by 4.4 percentage points and non-maturing loans by 0.4 percentage points during the stress period (the coefficients on Maturing$_{i,t}$ $\times$2023-on$_{i,t}$ and 2023-on$_{i,t}$, respectively). Banks with low capital reduced extensions of maturing and non-maturing loans by an additional 0.3 and 0.4 percentage points (the coefficients on the aforementioned variables interacted with Low Capital$_{b(i),t}$). However, the differences are statistically insignificant.

Table A.8 shows that changes in the stringency of extension terms were generally similar at low and high capital banks. The increase in the shares of extensions receiving material paydowns and higher spreads during the period of stress were 2.7 percentage points and 4.3 percentage points greater, respectively, for low capital banks. However, loans at low capital banks were also more likely to have balances rise or spreads fall when extended, indicating that the

[20] The discrepancy is due to two factors: First, outcomes in Figure 9 are weighted, and second, they only examine outcomes of loans with pending maturities. The specification in Table A.6 predicts that loans extended during the period of stress outperform other extensions by 4.6 percentage points, and non-extended loans by 1.7 percentage points, when regressions weight by loan balance and restrict the sample to loans within a year of maturity, more in line with the outcomes in Figure 9.

differences reflect a greater general tendency to adjust terms when extending loans rather than a difference in overall stringency. On net, the change in paydowns and spreads were about the same for high and low capital banks. The differences by bank capitalization are small relative to the broader changes during the period of stress: Low and high capital banks alike increased paydowns, spreads, and recourse requirements when extending loans during the period of stress (though recourse results are insignificant).

Differences by loan risk The findings so far regarding the effects of proximity to capital requirements indicate that (i) more capital constrained banks, if anything, provided fewer extensions during the period of stress and (ii) high and low capital banks increased paydown requirements and loan rate spreads by similar amounts during the stress. In other words, capitalization relates only weakly to extension patterns.

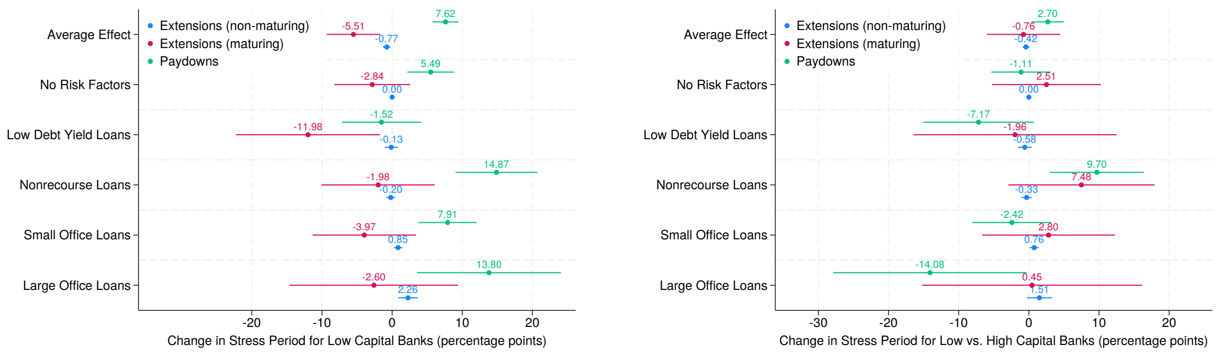
One pessimistic interpretation of these findings is that low capital banks tried to discourage extensions from high-quality borrowers (so loans would pay off and free up capital) while encouraging them from those who might default without generous extension policies. Namely, aggregate patterns might mask a shift in the composition of extensions for more constrained banks.

To assess this possible explanation, I repeat the analysis from Tables A.7 and A.8, but add additional interaction terms to capture how capitalization relates to extension frequencies and terms for borrowers with different risk characteristics. Every specification includes lower-level interaction terms and bank-quarter fixed effects. As the bank-quarter fixed effect controls for any broad tendency to provide extensions or change loan terms, the estimates reflect differences in how banks manage extensions by credit risk.

Figure 10 summarizes the main findings from this analysis, while the disaggregated regression estimates are reported in Tables A.9 and A.10. The left figure shows how extension policies at low capital banks changed during the period of stress. Red dots plot the change in extension rates for loans at low capital banks that are scheduled to mature next quarter, the blue dots the change in extension rates for nonmaturing loans, and the green dots the change in how often extended loans have a principal pay down of at least 5%. The right figure plots the change in extension outcomes for low capital banks relative to high capital banks. The top row presents overall estimates (from regressions without the risk factor interactions), and the other rows plot results from the fully-interacted specification; No Risk Factor reports the predicted extension outcomes for a recourse, non-office loan, with a debt yield over 8%, and the other rows report estimates for a loan with a single risk factor.

If proximity to a capital buffer induces low capital banks to extend and pretend, we would expect those banks to disproportionately extend riskier loans (red and blue dots would be to the right of the zero line for loans with the listed risk factors) and provide lenient extension policies to induce borrowers to extend (green dots would fall to the left of the zero line, indicating fewer extensions with principal paydowns).

Figure 10: Extension Policies by Bank Capitalization



(a) Change for Low Capital Banks

(b) Change Relative to High Capital Banks

Notes: The left figure plots the predicted changes in extension outcomes during the stress period for low capital banks. Outcomes considered are the predicted change in the probability that a nonmaturing loan is extended (blue), that a maturing loan is extended (red) and that an extended loan receives a principal paydown of at least 5%. These estimates come from fully-interacting the specifications in equations (2) and (3) with a low capital indicator. The average effect comes from the specification excluding interactions with loan risk factors, and the other estimates provide predictions for a loan with a single risk factor (besides the ”No Risk Factor” line which pertains to loans where all of the indicators in $X_{i,t}$ are 0). The right panel presents estimates of the change in policies at low capital banks net of the change at high capital banks (e.g., for paydowns, the No Risk Factor dot plots the coefficient on Low Capital$_{i,t}$ $\times$2023-on$_{i,t}$ $\times$Extension$_{i,t}$, while the others add the coefficient on the relevant quadruple interaction).

There is no area where this combination of easing terms and rising quantities occurred. The only evidence of low capital banks providing more extensions of risky loans is with nonmaturing office loans; nonmaturity extension rates rose by 0.9 and 2.3 percentage points for small and large office loans, respectively. However, the frequency of principal paydowns rose about 7.9 and 13.8 percentage points for these loans, indicating that the change was not prompted by easier extension policies.

The only risk category not associated with higher paydown requirements for low capital banks during the stress period is low debt yield loans, for which paydowns were roughly unchanged.[21] However, this lack of tightening for low debt yield loans does not appear to have stimulated more extensions, as their maturity extension rate fell by 12 percentage points.

The right panel plots estimates for the change in extension outcomes at low capital banks net of the change at high capital banks. This analysis examines whether low capital banks eased extension policies relative to other banks even if they did not ease policies in general. If paydowns rose broadly due to greater risks, or extensions fell because more borrowers defaulted, we might still see relatively smaller shifts for low capital banks if these developments were partially counteracted by some capital-preservation-motivated extensions.

There is little consistent evidence of extension policies becoming more stringent at one type of bank relative to the

[21] Low debt yield loans were about 4 percentage points more likely to entail principal paydowns before the pandemic, so part of this result could be that risks from low debt yield loans were already priced in before the pandemic, whereas there was more of a change for office loans due to the additional stresses for the property type.

other. Low capital banks reduced paydowns for low-debt-yield loans relative to high capital banks, but they also were less likely to extend such loans. Conversely, low capital banks disproportionately increased paydown requirements for nonrecourse loans, but did not see a drop in extensions for such loans. The one result that points to potential extend at pretend activity is with large office loans, for which paydown rates fell by 14 percentage points and the rate of nonmaturity extensions rose by 1.5 percentage points, both relative to high capital banks. However, even there, the changes only reflect a relative easing in terms, as the left chart shows that low capital banks still increased paydowns for large office loans by about 14 percentage points. Namely, the difference reflects extremely tight terms for well capitalized banks rather than easy terms from low capital banks.

Differences in the performance of extended loans Table A.11 repeats the analysis from Table A.6, but adding an extra interaction with Low Capital$_{b(i),t}$. The specification with quarter fixed effects— which compares the performance of extended loans relative to other loans in the same quarter—shows that the performance of extended loans improved somewhat for low capital banks during the period of stress (payoff rates rose about 2 percentage points), and deteriorated slightly for better capitalized banks. However, the difference between high and low capital banks mostly goes away when bank-quarter fixed effects are added in column (3). Overall, there is no evidence that the probability of future repayment deteriorated for extensions made by low capital banks during the period of stress.

To summarize the bank capital results, low and high capital banks alike reduced extensions and tightened extension terms, particularly for riskier loans. These results suggest that proximity to capital buffers did not induce banks to provide lenient extension policies to extend loans with little hope of repayment. Indeed stress-era extensions paid off at similar (if not slightly higher) rates than extensions from before the pandemic.

5. CONCLUSION

This paper uses detailed supervisory data on bank CRE loans to assess how banks used extensions to manage CRE market strains following the pandemic. I present four pieces of evidence that run counter to the notion that extensions reflect "extend and pretend" behavior brought about by recent banking strains. First, the frequency of extension during the period of stress was not significantly different from what was observed during normal times. Namely, frequent CRE loan extensions is business as usual, rather than a consequence of the bank or CRE market strains. Second, banks reduced extensions for the income-strained properties where extend and pretend incentives would be the strongest. Third, extension terms became more stringent during the stress period. Rather than provide highly-subsidized credit, banks increasingly required equity contributions and higher spreads from borrowers to extend loans. Fourth, the probability that extended loans successfully paid off did not deteriorate for stress-era extensions, demonstrating that most extensions were for financially viable loans. Moreover, these four patterns hold even for banks closer to their capital requirements, inconsistent with capital preservation incentives motivating banks to adopt lenient extension policies.

Instead, the findings are generally consistent with borrowers using extensions to mitigate the effects of market illiquidity. A model of CRE loan maturity outcomes demonstrates that there are two different kinds of extensions. First, there are lender-driven extensions, where lenders provide favorable loan terms to highly-strained borrowers in order to limit the costs of loan resolution or loss recognition. These extensions are characterized by low debt yields and easy terms in order to motivate borrowers to extend rather than default (inconsistent with the empirical findings). Second, there are borrower-driven extensions where borrowers want to buy time to sell or refinance a property, and are willing to offer credit enhancements to lenders to motivate them to extend loans. These extensions are characterized by high principal paydowns for loans with weaker incomes, consistent with the finding of this paper.

In short, observed extension patterns generally indicate that banks are efficiently managing the risks associated with loan extensions. However, one significant limitation of this work is that it only covers larger banks, which tend to be less exposed to CRE loans and thus perhaps have weaker extend and pretend incentives. In complementary work, Glancy and Kurtzman (2024) demonstrate that small banks' superior CRE loan performance can mostly be attributed to loan portfolio composition, leaving little room for extend and pretend behavior to contribute to performance disparities. Taken together, these papers thus indicate that (i) large banks do not extend and pretend and (ii) small banks do not obscure delinquency *relative to large banks*. This line of work therefore provides suggestive evidence against pervasive extend and pretend behavior at small banks, however, more direct analysis on this topic would valuable.

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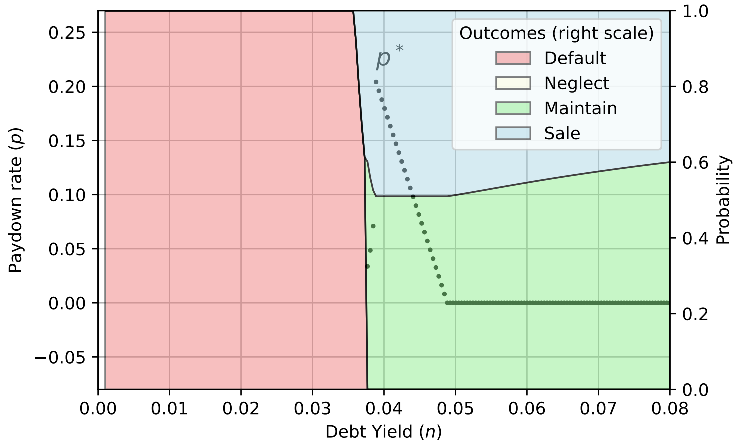
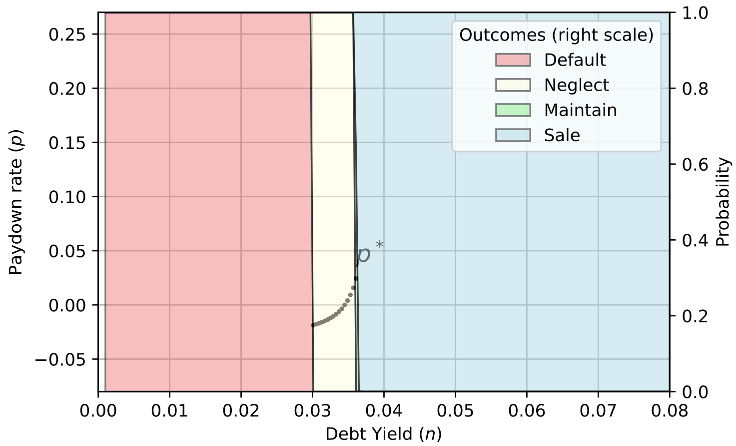
APPENDIX

A. ADDITIONAL TABLES AND FIGURES

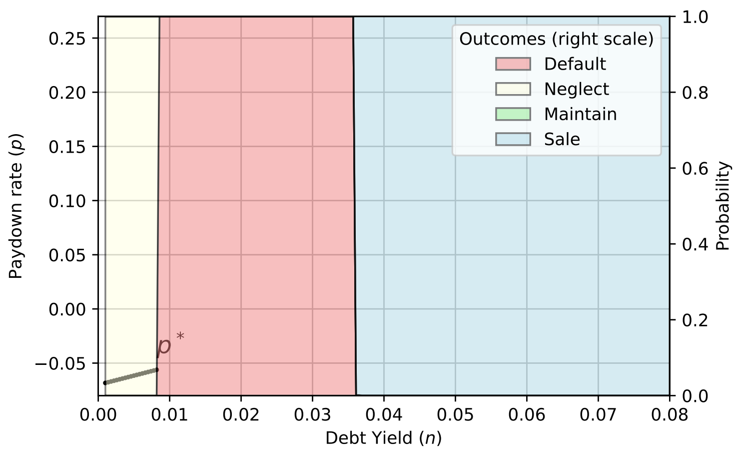
Figure A.1: What Drives Extensions



(a) Just Search Costs ($\Lambda = \frac{\alpha}{1+\alpha}$)



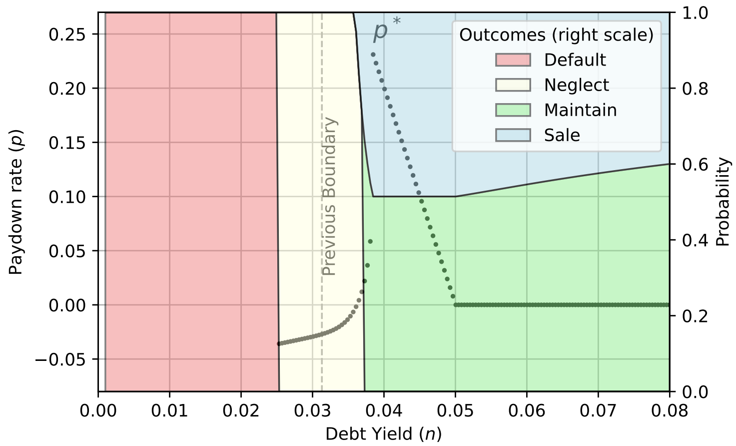
(b) Just Foreclosure Cost ($\alpha = 1000$)



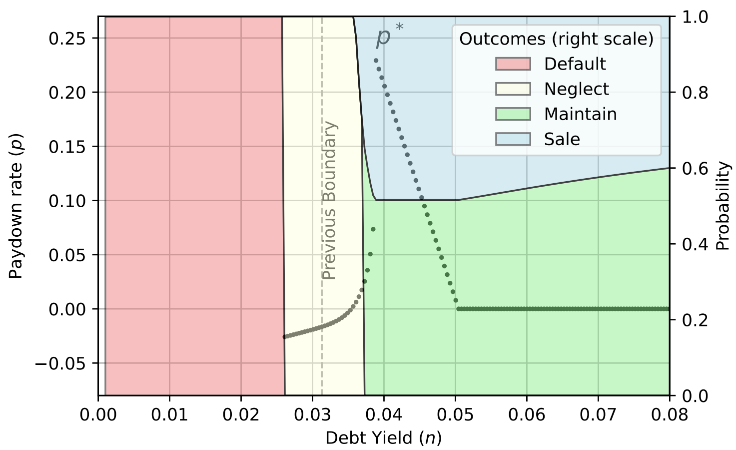
(c) Just Capital Costs ($\chi = .01, \alpha = 1000, \Lambda = \frac{\alpha}{1+\alpha}$)

Notes: Each chart presents a stacked area chart showing the probability that a loan with a given debt yield defaults (red), extends and neglects (yellow), extends and maintains (green) or pays off at maturity (blue). Black dots plot $p^*(n)$. Parameters are as in Table A.1, except only including one friction at a time. Panel (a) just has search costs ($\Lambda = \frac{\alpha}{1+\alpha}$ means lenders have no disadvantage in liquidations as costs are the same as a borrower being forced to sell). Panel (b) just has foreclosure costs ($\alpha = 1000$ essentially turns off search costs). Panel (c) just has capital costs (setting $\chi = .01$ and turning off search and foreclosure costs).

Figure A.2: Debt Overhang vs. Foreclosure Cost Trade-offs



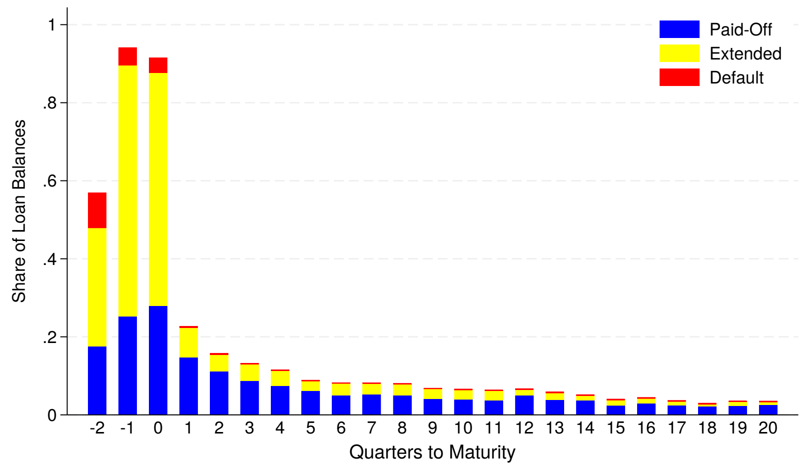
(a) Reducing ν and λ by half



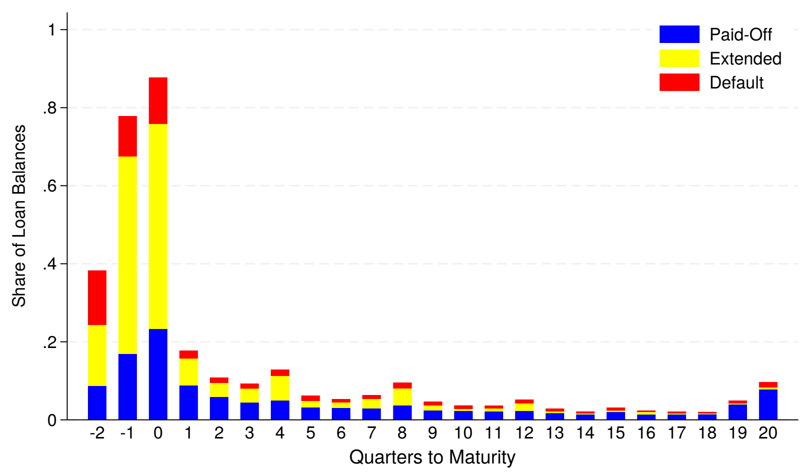
(b) Decreasing Λ by 0.07

Notes: Each chart presents a stacked area chart showing the probability that a loan with a given debt yield defaults (red), extends and neglects (yellow), extends and maintains (green) or pays off at maturity (blue). Black dots plot $p^*(n)$. Parameters are as in Table A.1, except panel (a) reduces the amount that borrowers can extract by deferring maintenance by half while keeping the return to maintenance the same (θ and ν are cut in half) and panel (b) reduces the recovery amounts by 7 percentage points (to $\Lambda = 0.69$). The dashed line shows the threshold below which borrowers defaulted in the baseline calibration (before changing debt overhang effects or foreclosure costs).

Figure A.3: Loan Outcomes by Time to Maturity



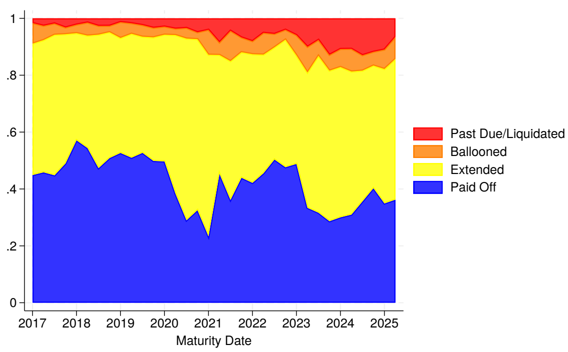
(a) Pre-COVID



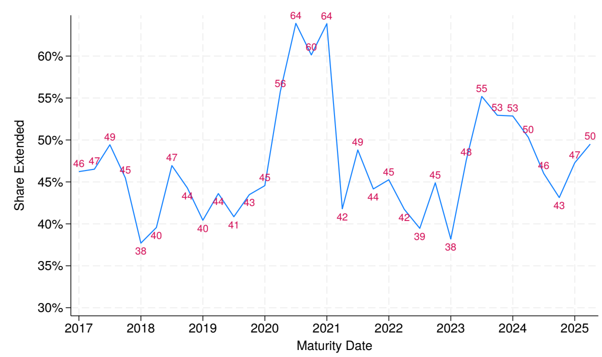
(b) 2023-on

Notes: These figures report loan outcomes by the number of quarters to maturity. Each bar shows the share of outstanding loan balances that are paid off (blue), extended (yellow) and delinquent or liquidated (red). The top panel shows results for the years 2016-2019, and the bottom years from 2023-2025. Quarters to maturity is based on the previous quarter's maturity date. For example, the 0 bar shows the outcomes for loans that were scheduled to mature that quarter as of the previous quarter. I do not show a bar for ballooned loans since that outcome can only occur following maturity.

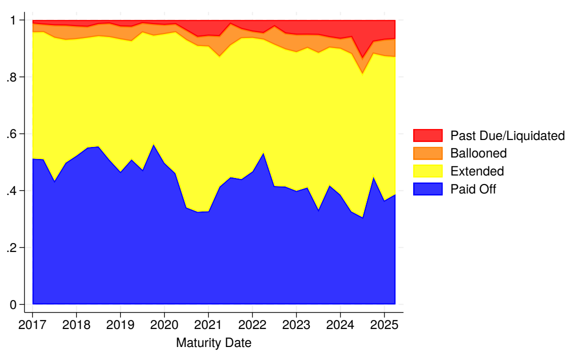
Figure A.4: Outcomes of Pending CRE Loan Maturities, By Stabilization



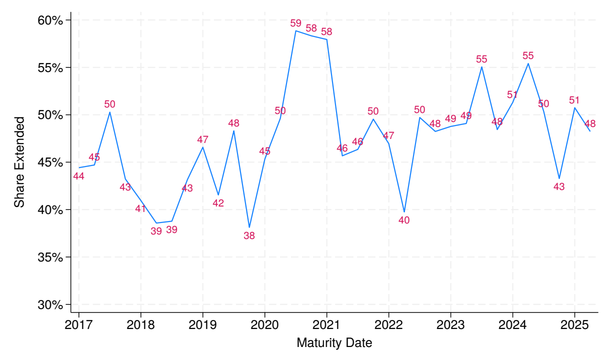
(a) Maturity Outcomes, Stabilized Properties



(b) Extension Rates, Stabilized Properties



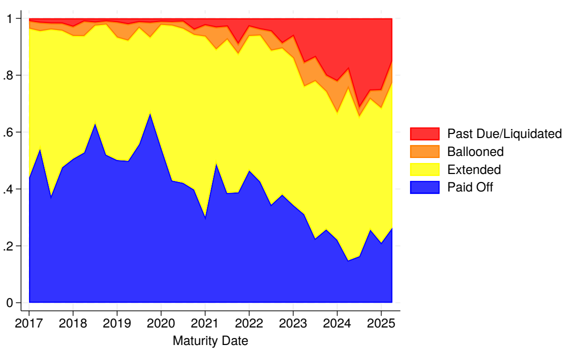
(c) Maturity Outcomes, Non-stabilized Properties



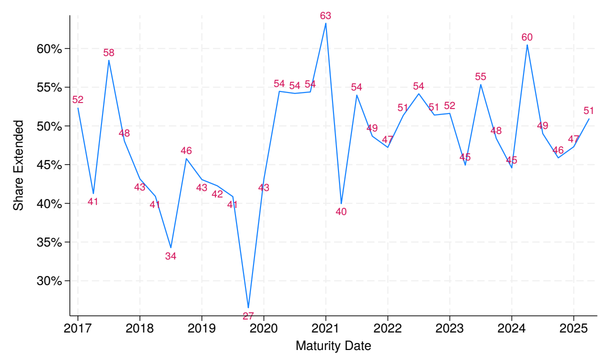
(d) Extension Rates, Non-stabilized Properties

Notes: The left figures show the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. The right panels shows the share of balances that are extended, corresponding to the yellow region in the left charts. The top panels pertain to stabilized properties, and the bottom panels non-stabilized properties. Loan balances and scheduled maturity dates are measured as of four quarters before the scheduled maturity.

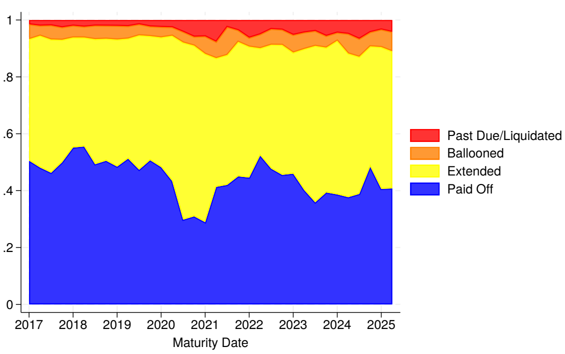
Figure A.5: Outcomes of Pending CRE Loan Maturities, By Property Type



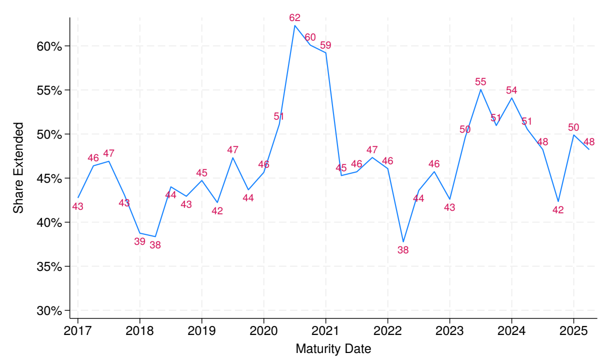
(a) Maturity Outcomes, Office Properties



(b) Extension Rates, Office Properties



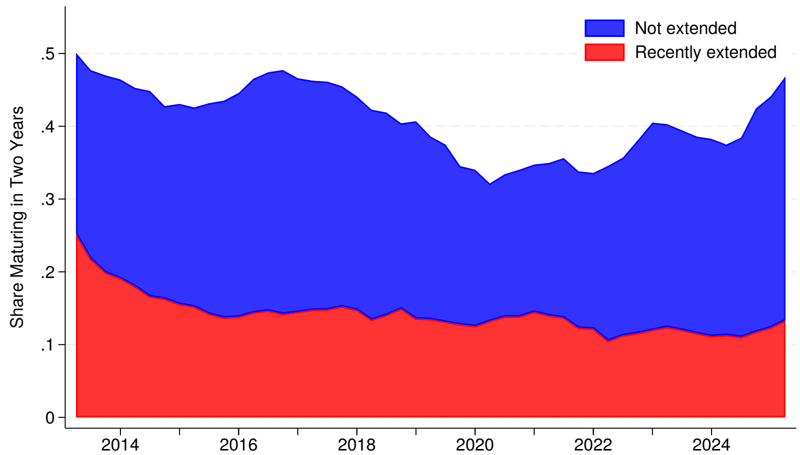
(c) Maturity Outcomes, Non-office Properties



(d) Extension Rates, Non-office Properties

Notes: The left figures show the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. The right panels shows the share of balances that are extended, corresponding to the yellow region in the left charts. The top panels pertain to office properties, and the bottom panels non-office properties. Loan balances and scheduled maturity dates are measured as of four quarters before the scheduled maturity.

Figure A.6: Maturities in Next Two Years



Notes: This figure plots the share of outstanding CRE loans that are scheduled to mature in the next two years over time (the top of the blue area), and the portion of those loans accounted for by loans that have received extensions in the past two years (the red area).

Table A.1: Parameters used in baseline model

Parameter	Description	Value
r	Discount rate	0.045
r_m	Mortgage rate	0.07
g	Expected NOI Growth	0.01
σ	Standard Deviation of NOI Growth	0.1
α	Pareto Shape Parameter	12.3
Λ	Recovery Factor	0.76
θ	Decline in NOI from Neglect	0.045
ν	Temporary NOI Boost From Neglect	0.69
χ	Cost to Loss Recognition	0

Notes: $r = 4.5$ set to match 30-year Treasury yields in the period of stress, and $r_m = 7\%$ to match spreads in Glancy et al. (2022). α is based on search frictions estimated in Sagi (2021). g and σ are set to match the statistics on annual rent growth in An et al. (2016). Λ and θ are based on foreclosure costs in Brown et al. (2006). ν is set so that deferred maintenance is an equal-sized transfer and deadweight loss. In the baseline calibration, I set $\chi = 0$ based on Favara et al. (2024). See Appendix B.4 for details.

Table A.2: Select Summary Statistics

	Mean	Std	p10	p50	p90	N
2023-on$_t$	0.43	0.50	0.00	0.00	1.00	1,648,461
Maturing$_{i,t}$	0.03	0.17	0.00	0.00	0.00	1,648,461
Extension$_{i,t+1}$	0.03	0.16	0.00	0.00	0.00	1,546,492
Default$_{i,t+1}$	0.01	0.12	0.00	0.00	0.00	1,473,156
Paid off$_{i,t+1}$	0.19	0.39	0.00	0.00	1.00	1,546,492
Debt Yield$_{i,t}$	0.12	0.05	0.07	0.11	0.20	548,248
Low Debt Yield$_{i,t}$	0.07	0.26	0.00	0.00	0.00	1,648,461
Nonrecourse$_{i,t}$	0.34	0.47	0.00	0.00	1.00	1,648,461
Small Office$_{i,t}$	0.11	0.31	0.00	0.00	1.00	1,648,461
Large Office$_{i,t}$	0.01	0.12	0.00	0.00	0.00	1,648,461
Missing Debt Yield$_{i,t}$	0.67	0.47	0.00	1.00	1.00	1,648,461
Stabilized$_{i,t}$	0.69	0.46	0.00	1.00	1.00	1,648,461
Paydown$_{i,t}$	0.01	0.03	0.00	0.01	0.01	1,389,187
$\mathbb{1}(\text{Paydown} > 5\%)_{i,t}$	0.01	0.11	0.00	0.00	0.00	1,389,187
$\mathbb{1}(\Delta\text{Balance} > 0)_{i,t}$	0.04	0.19	0.00	0.00	0.00	1,389,187
Gained Recourse$_{i,t}$	0.01	0.09	0.00	0.00	0.00	473,764
ΔSpread$_{i,t}$	0.00	0.00	0.00	0.00	0.00	748,473
$\Delta\mathbb{1}(\text{Spread} > 0)_{i,t}$	0.04	0.19	0.00	0.00	0.00	748,473
$\Delta\mathbb{1}(\text{Spread} < 0)_{i,t}$	0.03	0.17	0.00	0.00	0.00	748,473
Low Capital$_{b(i),t}$	0.38	0.48	0.00	0.00	1.00	1,436,889

Notes: Excludes years 2020-2022 to remain consistent with regression samples. Paid off$_{i,t+1}$ is missing for 2025q2 observations and for loans that exited the sample for non-standard reasons (e.g., balances falling below the reporting threshold). Stabilized$_{i,t}$ is an indicator for whether the property is not a construction loan, and the value is reported as is (rather than as completed or as stabilized). Debt Yield$_{i,t}$ is bottom- and top-codded at 0 and 0.2, respectively. Missing Debt Yield$= 1$ for nonstabilized loans or loans where NOI has not been updated in the last year. Paydown variables exclude quarters with charge-offs or changes in utilization. Paydown$_{i,t}$ is bottom- and top-coded at -.5 and .5, respectively. Gained Recourse$_{i,t}$ is missing for loans that already had recourse. Variables measuring changes in spreads are missing for loans that do not have floating rates. Bank capital is missing when banks first enter the sample as reporting begins before the first stress test results come out.

Table A.3: Select Summary Statistics

	$\text{2023-on}_{i,t} = 0$	$\text{2023-on}_{i,t} = 1$	$\text{Maturing}_{i,t} = 1$	$\text{Extension}_{i,t} = 1$
	(1)	(2)	(3)	(4)
2023-on_t	0.00	1.00	0.38	0.33
$\text{Maturing}_{i,t}$	0.03	0.03	1.00	0.25
$\text{Extension}_{i,t+1}$	0.03	0.02	0.53	0.16
$\text{Default}_{i,t+1}$	0.01	0.02	0.11	0.05
$\text{Paid off}_{i,t+1}$	0.21	0.16	0.55	0.34
$\text{Debt Yield}_{i,t}$	0.12	0.11	0.12	0.12
$\text{Low Debt Yield}_{i,t}$	0.08	0.06	0.05	0.06
$\text{Nonrecourse}_{i,t}$	0.29	0.39	0.26	0.28
$\text{Small Office}_{i,t}$	0.12	0.10	0.15	0.13
$\text{Large Office}_{i,t}$	0.01	0.01	0.02	0.03
$\text{Missing Debt Yield}_{i,t}$	0.63	0.72	0.76	0.70
$\text{Stabilized}_{i,t}$	0.68	0.71	0.42	0.40
$\text{Paydown}_{i,t}$	0.01	0.01	0.01	-0.00
$\mathbb{1}(\text{Paydown} > 5\%)_{i,t}$	0.01	0.01	0.03	0.07
$\mathbb{1}(\Delta\text{Balance} > 0)_{i,t}$	0.02	0.07	0.06	0.13
$\text{Gained Recourse}_{i,t}$	0.01	0.00	0.02	0.05
$\Delta\text{Spread}_{i,t}$	0.00	0.00	0.00	0.00
$\Delta\mathbb{1}(\text{Spread} > 0)_{i,t}$	0.03	0.05	0.05	0.12
$\Delta\mathbb{1}(\text{Spread} < 0)_{i,t}$	0.03	0.03	0.03	0.12
$\text{Low Capital}_{b(i),t}$	0.35	0.42	0.46	0.48
Observations	933,209	715,252	48,547	44,543

Notes: Each column presents the mean of the variables of interest for a subset of the data. Column (1) summarizes variables in the prepandemic period, column (2) for the stress period, (3) for loans that are scheduled to mature next period, and (4) for loans that were extended in a given quarter.

Table A.4: Extensions During the Stress Period

	$100\times$Extension$_{i,t+1}$			$100\times$Default$_{i,t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Maturing$_{i,t}\times$2023-on$_{i,t}$	-4.69**	-1.99	-2.00	4.59**	1.57	1.08
	(1.26)	(1.89)	(1.89)	(0.74)	(0.98)	(0.96)
...$\times$Low Debt Yield$_{i,t}$		-9.43**	-8.51*		4.27^{+}	3.95^{+}
		(3.51)	(3.47)		(2.18)	(2.13)
...$\times$Nonrecourse$_{i,t}$		-3.82	-4.26*		3.74**	4.33**
		(2.39)	(2.15)		(1.33)	(1.27)
...$\times$Small Office$_{i,t}$		-0.78	-0.83		3.40**	2.98*
		(1.75)	(1.72)		(1.22)	(1.23)
...$\times$Large Office$_{i,t}$		0.95	0.71		10.78**	10.29**
		(3.44)	(3.42)		(2.40)	(2.38)
Maturing$_{i,t}$	53.18**	54.73**	53.86**	5.33**	4.75**	4.56**
	(0.60)	(0.99)	(1.04)	(0.31)	(0.45)	(0.46)
...$\times$Low Debt Yield$_{i,t}$		5.39*	4.34^{+}		3.17**	3.36**
		(2.60)	(2.57)		(1.03)	(0.99)
...$\times$Nonrecourse$_{i,t}$		1.29	1.07		-0.96	-1.54**
		(1.08)	(1.08)		(0.59)	(0.57)
...$\times$Small Office$_{i,t}$		-2.61**	-1.99*		1.62**	2.44**
		(0.97)	(0.95)		(0.48)	(0.52)
...$\times$Large Office$_{i,t}$		1.10	2.14		-3.24**	-2.31**
		(2.21)	(2.21)		(0.67)	(0.70)
2023-on$_{i,t}$	-0.59**	-0.25		0.70**	-0.25	
	(0.21)	(0.22)		(0.20)	(0.16)	
...$\times$Low Debt Yield$_{i,t}$		0.51*	0.28		1.43**	1.37**
		(0.22)	(0.18)		(0.40)	(0.37)
...$\times$Nonrecourse$_{i,t}$		-0.57*	-0.04		1.00*	0.72**
		(0.28)	(0.16)		(0.40)	(0.17)
...$\times$Small Office$_{i,t}$		0.22	0.31*		1.63**	1.43**
		(0.15)	(0.14)		(0.16)	(0.16)
...$\times$Large Office$_{i,t}$		1.47**	1.46**		13.31**	13.19**
		(0.53)	(0.44)		(0.83)	(0.85)
R^2_a	0.288	0.288	0.313	0.017	0.024	0.080
Observations	1,546,480	1,546,480	1,546,479	1,473,144	1,473,144	1,473,143
Bank FE?	✓	✓		✓	✓	
Bank Quarter FE?			✓			✓
Controls	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100\times\text{Extension}_{i,t+1} = (\beta' X_{i,t})\times\text{2023-on}_t\times\text{Maturing}_{i,t} + \gamma'\text{Lower Level Controls}_{i,t} + \tau_{b(i)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1)–(3) and an indicator for if it is delinquent in (4)–(6). These outcomes are not mutually exclusive. 2023-on$_t$ is 1 for quarters starting in 2023q1 and 0 before the pandemic. Maturing$_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), secured by a large office, and an indicator for if debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for uninteracted $X_{i,t}$ controls, and all interactions with the missing debt yield indicator are not displayed. Relative to the listed specification, columns (1) and (4) omit the interaction with $X_{i,t}$, and columns (3) and (6) add bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.5: Extensions Terms by Risk Factors

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}$(ΔSpread > 0)	$\mathbb{1}$(ΔSpread < 0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Extension}_{i,t} \times \text{2023-on}_{i,t}$	3.15**	2.81**	-5.57**	0.89	0.13**	15.27**	-10.88**
	(0.56)	(0.86)	(2.05)	(1.01)	(0.02)	(1.51)	(1.64)
$\ldots\times\text{Low Debt Yield}_{i,t}$	-1.17	3.69	-4.15	-1.97	-0.03	-8.62**	0.00
	(0.83)	(2.79)	(3.60)	(1.27)	(0.04)	(3.17)	(2.77)
$\ldots\times\text{Nonrecourse}_{i,t}$	0.88	2.73*	-3.53		0.04*	1.67	-2.45^{+}
	(0.60)	(1.35)	(2.46)		(0.02)	(1.66)	(1.33)
$\ldots\times\text{Small Office}_{i,t}$	0.38	3.94**	0.41	2.48	0.07**	7.88**	-0.10
	(0.43)	(1.26)	(1.53)	(1.63)	(0.02)	(1.59)	(1.15)
$\ldots\times\text{Large Office}_{i,t}$	1.12	14.31**	-11.87**	3.20^{+}	0.11**	12.31**	-1.91
	(0.95)	(3.07)	(3.87)	(1.72)	(0.04)	(2.40)	(2.73)
$\text{Extension}_{i,t}$	-4.04**	2.26**	15.68**	1.69**	-0.04**	6.72**	16.91**
	(0.48)	(0.35)	(1.52)	(0.55)	(0.01)	(0.71)	(1.43)
$\ldots\times\text{Low Debt Yield}_{i,t}$	3.81**	4.04*	-2.22	-0.63	0.03	6.52**	-0.96
	(0.70)	(1.58)	(3.28)	(0.68)	(0.03)	(2.24)	(2.51)
$\ldots\times\text{Nonrecourse}_{i,t}$	-0.47	-0.17	4.02*		0.00	0.18	0.67
	(0.51)	(0.61)	(1.81)		(0.01)	(0.62)	(0.97)
$\ldots\times\text{Small Office}_{i,t}$	0.35	-0.92^{+}	-0.59	0.93	-0.00	-0.33	-0.73
	(0.31)	(0.49)	(1.02)	(0.88)	(0.01)	(0.71)	(0.85)
$\ldots\times\text{Large Office}_{i,t}$	1.73*	-0.03	-1.83	-2.32*	-0.03*	-1.60	1.95
	(0.75)	(1.40)	(2.60)	(0.97)	(0.01)	(1.03)	(2.19)
$\text{2023-on}_{i,t}$							
$\ldots\times\text{Low Debt Yield}_{i,t}$	0.03	0.12	0.25	-0.13	-0.00	-3.18**	-2.43**
	(0.03)	(0.17)	(0.75)	(0.13)	(0.01)	(0.96)	(0.79)
$\ldots\times\text{Nonrecourse}_{i,t}$	-0.01	-0.02	-0.23		0.00^{+}	-0.37	-0.21
	(0.03)	(0.17)	(1.44)		(0.00)	(0.53)	(0.46)
$\ldots\times\text{Small Office}_{i,t}$	0.13**	0.33**	-0.73*	0.10	0.00*	1.28**	0.81**
	(0.03)	(0.11)	(0.36)	(0.25)	(0.00)	(0.28)	(0.25)
$\ldots\times\text{Large Office}_{i,t}$	0.06	0.57	14.43**	0.79	0.02**	1.14*	0.27
	(0.11)	(0.35)	(2.03)	(0.56)	(0.00)	(0.56)	(0.42)
R^2_a	0.059	0.071	0.140	0.172	0.110	0.296	0.190
Observations	1,244,405	1,244,405	1,244,405	473,257	651,273	651,273	651,273
Bank-Quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = (\beta' X_{i,t-1}) \times \text{2023-on}_t \times \text{Extension}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are an indicator if the loan receives an extension and an indicator for whether the quarter is 2023 or later. $X_{i,t-1}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), secured by a large office, and an indicator for if debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for uninteracted $X_{i,t}$ controls; controls for age, size, amortization, and previous spread; and all interactions with the missing debt yield indicator are not displayed. $\tau_{b(i),t}$ is a bank-quarter fixed effect. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.6: Payoffs By Previous Extension

	$100\times$Paid Off$_{i,t+1}$		
	(1)	(2)	(3)
Extended$_{i,t}$	-2.02**	-2.47**	-2.32**
	(0.49)	(0.44)	(0.39)
Extended 2023-on$_{i,t}$	-4.17**	0.27	0.47
	(0.97)	(0.71)	(0.61)
R^2_a	0.112	0.128	0.142
Observations	1,544,558	1,544,558	1,544,557
Quarter-to-Maturity FE?	✓	✓	✓
Bank FE?	✓	✓	
Quarter FE?		✓	
Bank Quarter FE?			✓

Notes: This table presents estimates from the equation

$$100 \times \text{Paid Off}_{i,t+1} = \beta_1 \text{Extended}_{i,t} + \beta_2 \text{Extended 2023-on}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether an outstanding loan paid off the following quarter. Extended$_{i,t}$ is an indicator for whether the loan was previously extended, and Extended 2023-on$_{i,t}$ is a indicator if the loan was extended during the period of stress. $\tau_{b(i),t}$ and $\alpha_{m(i,t)}$ are bank-quarter and quarters-to-maturity fixed effects. Relative to the specification above, columns (1) and (2) replace the bank-quarter fixed effects with bank fixed effects and bank and quarter fixed effects, respectively. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.7: Maturity Extensions By Capitalization

	$100{\times}\text{Extension}_{i,t+1}$	$100{\times}\text{Default}_{i,t+1}$
	(1)	(2)
Low $\text{Capital}_{b(i),t}$	0.02	0.07
	(0.25)	(0.12)
$\ldots{\times}\text{Maturing}_{i,t}{\times}\text{2023-on}_{i,t}$	-0.34	-1.28
	(2.70)	(1.13)
$\ldots{\times}\text{Maturing}_{i,t}$	1.47	-1.10
	(1.26)	(0.70)
$\ldots{\times}\text{2023-on}_{i,t}$	-0.42	-0.18
	(0.26)	(0.18)
$\text{Maturing}_{i,t}{\times}\text{2023-on}_{i,t}$	-4.40*	6.20**
	(1.81)	(0.67)
$\text{Maturing}_{i,t}$	51.99**	2.79**
	(0.88)	(0.24)
$\text{2023-on}_{i,t}$	-0.35**	0.47**
	(0.10)	(0.09)
R^2_a	0.295	0.063
Observations	1,410,567	1,413,035
Bank FE?	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \text{Extension}_{i,t+1} = \beta \text{Low Capital}_{b(i),t} \times \text{2023-on}_t \times \text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1) and an indicator for if it is delinquent in (2). Low $\text{Capital}_{b(i),t}$ is 1 for banks closer than the median to their capital buffer (determined by the banks' minimum CET1 ratio in the severely adverse scenario in the pre-SCB era and the distance to the bank-specific CET1 capital buffer, inclusive of the SCB and G-SIB surcharge, in the SCB-era). 2023-on_t is 1 for quarters starting in 2023q1 and 0 before the pandemic. $\text{Maturing}_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.8: Extension Terms By Capitalization

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}$(ΔSpread > 0)	$\mathbb{1}$(ΔSpread < 0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low Capital$_{b(i),t}$ ×Extension$_{i,t}$	0.33	-0.51	-2.86^{+}	-1.13	0.01	-0.67	-3.18*
	(0.52)	(0.69)	(1.71)	(1.10)	(0.01)	(0.81)	(1.28)
...×2023-on$_t$	0.06	2.70*	3.80^{+}	-0.23	0.00	4.32^{+}	4.46**
	(0.61)	(1.17)	(2.25)	(1.78)	(0.02)	(2.47)	(1.68)
Extension$_{i,t}$	-2.22**	3.32**	12.18**	2.69**	-0.03**	5.53**	13.50**
	(0.29)	(0.42)	(1.11)	(0.91)	(0.01)	(0.43)	(0.96)
...×2023-on$_t$	2.87**	4.92**	-8.80**	1.98	0.10**	9.60**	-9.88**
	(0.34)	(0.69)	(1.48)	(1.35)	(0.01)	(1.84)	(1.27)
R^2_a	0.053	0.072	0.133	0.177	0.120	0.298	0.137
Observations	1,086,286	1,086,286	1,086,286	394,537	575,108	575,108	575,108
Bank-quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = \beta \text{Extension}_{i,t} \times \text{2023-on}_t \times \text{Low Capitalized}_{b(i),t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are indicators for whether the loan receives an extension, the time period is 2023 or later, and the loan is held by a bank holding company that is closer than the median to its regulatory capital constraint. Unreported controls include interactions of the main variables of interest that do not include Extension$_{i,t}$, and controls for a loan's age, size, amortization, and previous spread. $\tau_{b(i),t}$ is a bank-quarter fixed effect. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.9: Maturity Extensions By Capitalization and Risk Characteristics

	$100\times\text{Extension}_{i,t+1}$		$100\times\text{Default}_{i,t+1}$	
	(1)		(2)	
Low $\text{Capital}_{b(i),t} \times \text{Maturing}_{i,t} \times \text{2023-on}_{i,t}$	2.51	(3.96)	-1.41	(1.64)
...$\times$Low Debt $\text{Yield}_{i,t}$	-3.89	(7.27)	-14.98**	(4.94)
...$\times\text{Nonrecourse}_{i,t}$	5.31	(4.52)	1.47	(2.19)
...$\times$Small $\text{Office}_{i,t}$	-0.46	(3.51)	-5.48*	(2.36)
...$\times$Large $\text{Office}_{i,t}$	-3.56	(7.23)	-6.36	(5.17)
Low $\text{Capital}_{b(i),t} \times \text{2023-on}_{i,t}$				
...$\times$Low Debt $\text{Yield}_{i,t}$	-0.58	(0.50)	0.84	(0.75)
...$\times\text{Nonrecourse}_{i,t}$	-0.33	(0.37)	0.18	(0.46)
...$\times$Small $\text{Office}_{i,t}$	0.76*	(0.34)	-0.18	(0.32)
...$\times$Large $\text{Office}_{i,t}$	1.51^{+}	(0.90)	5.31**	(1.58)
Low $\text{Capital}_{b(i),t} \times \text{Maturing}_{i,t}$	0.08	(2.21)	0.52	(0.75)
...$\times$Low Debt $\text{Yield}_{i,t}$	0.75	(5.38)	0.78	(2.51)
...$\times\text{Nonrecourse}_{i,t}$	0.00	(2.26)	-0.81	(1.16)
...$\times$Small $\text{Office}_{i,t}$	1.08	(1.99)	2.88**	(0.96)
...$\times$Large $\text{Office}_{i,t}$	-2.38	(4.53)	0.97	(1.50)
Low $\text{Capital}_{b(i),t}$				
...$\times$Low Debt $\text{Yield}_{i,t}$	0.37	(0.45)	-0.47	(0.32)
...$\times\text{Nonrecourse}_{i,t}$	0.36	(0.25)	0.46	(0.36)
...$\times$Small $\text{Office}_{i,t}$	-0.65*	(0.29)	0.14	(0.15)
...$\times$Large $\text{Office}_{i,t}$	-1.13^{+}	(0.68)	-1.17**	(0.25)
R^2_a	0.315		0.089	
Observations	1,410,567		1,413,035	
Bank-Quarter FE?	✓		✓	
Lower Level Interactions	✓		✓	

Notes: This table presents estimates from the equation

$$100\times\text{Extension}_{i,t+1} = (\beta' X_{i,t})\text{Low Capital}_{b(i),t}\times\text{2023-on}_t\times\text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1) and an indicator for if it is delinquent in (2). Low $\text{Capital}_{b(i),t}$ is 1 for banks closer than the median to their capital buffer (determined by the banks' minimum CET1 ratio in the severely adverse scenario in the pre-SCB era and the distance to the bank-specific CET1 capital buffer, inclusive of the SCB and G-SIB surcharge, in the SCB-era). 2023-on_t is 1 for quarters starting in 2023q1 and 0 before the pandemic. $\text{Maturing}_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), secured by a large office, and an indicator for if debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for variables not interacted with Low $\text{Capital}_{b(i),t}$ as well as all interactions with the missing debt yield indicator are not displayed. Standard errors, in parentheses in the right columns for each model, are clustered by bank-quarter. $^{+},^{*},^{**}$ indicate significance at 10%, 5%, and 1%, respectively.

Table A.10: Extension Terms By Capitalization and Risk Characteristics

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}(\Delta\text{Spread} > 0)$	$\mathbb{1}(\Delta\text{Spread} < 0)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low Capital$_{b(i),t}$ × Extension$_{i,t}$ × 2023-on$_{i,t}$	-0.48	1.74	8.50$^+$	0.80	-0.08$^+$	-2.09	8.23*
	(1.26)	(1.90)	(4.73)	(2.13)	(0.04)	(3.42)	(3.41)
...× Low Debt Yield$_{i,t}$	-1.91	-0.52	6.82	-3.89	-0.05	3.85	5.64
	(1.87)	(5.58)	(6.95)	(2.72)	(0.09)	(6.55)	(5.28)
...× Nonrecourse$_{i,t}$	3.14*	4.56	-13.55*		0.06	1.87	0.64
	(1.28)	(3.06)	(5.62)		(0.04)	(4.01)	(2.85)
...× Small Office$_{i,t}$	-0.31	-0.15	1.63	-4.32	0.03	6.53$^+$	0.36
	(0.92)	(3.04)	(3.22)	(3.69)	(0.04)	(3.40)	(2.44)
...× Large Office$_{i,t}$	-3.50	-13.10$^+$	10.42	-4.55	-0.13	-9.14$^+$	9.53$^+$
	(2.18)	(7.11)	(8.13)	(4.06)	(0.08)	(5.51)	(5.28)
Extension$_{i,t}$ × 2023-on$_{i,t}$	3.59**	2.62*	-8.54**	0.63	0.17**	16.51**	-15.26**
	(0.61)	(1.25)	(2.63)	(1.72)	(0.02)	(2.29)	(2.05)
...× Low Debt Yield$_{i,t}$	-0.21	3.74	-7.37	0.48	-0.02	-10.09*	-2.63
	(1.03)	(3.27)	(5.64)	(2.23)	(0.05)	(4.15)	(3.90)
...× Nonrecourse$_{i,t}$	-0.23	1.23	0.46		0.02	1.67	-2.42
	(0.66)	(1.59)	(3.05)		(0.02)	(2.36)	(2.15)
...× Small Office$_{i,t}$	0.63	4.19*	-1.17	4.79$^+$	0.05*	4.96*	-0.37
	(0.56)	(1.73)	(2.08)	(2.79)	(0.02)	(2.26)	(1.51)
...× Large Office$_{i,t}$	2.68*	22.03**	-17.18**	5.27$^+$	0.16**	16.02**	-5.34
	(1.35)	(4.66)	(5.87)	(2.86)	(0.05)	(4.20)	(3.43)
R^2_a	0.058	0.074	0.143	0.178	0.121	0.301	0.139
Observations	1,086,286	1,086,286	1,086,286	394,537	575,108	575,108	575,108
Bank-Quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = (\beta' X_{i,t-1})\text{Extension}_{i,t} \times \text{2023-on}_t \times \text{Low Capitalized}_{b(i),t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are interactions between indicators for whether (i) the bank holding the loan is closer than the median to its regulatory capital constraint, (ii) the loan was extended in quarter t, (iii) the observation is from the stress period and (iv) a risk factor: low debt yield, missing debt yield, nonrecourse, and small and large office indicators. All specifications include lower level interactions of all variables; controls for a loan's age, size, amortization and previous spread; and bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.11: Payoffs By Previous Extension and Capitalization

	$100\times$Paid $\text{Off}_{i,t+1}$		
	(1)	(2)	(3)
Low $\text{Capital}_{b(i),t}$	0.26	0.25	
	(0.93)	(0.70)	
...x $\text{Extended}_{i,t}$	-2.53^{+}	-1.83^{+}	-1.93*
	(1.39)	(1.01)	(0.84)
...x Extended $\text{2023-on}_{i,t}$	3.76*	2.56^{+}	0.47
	(1.75)	(1.42)	(1.50)
$\text{Extended}_{i,t}$	-1.40	-1.86**	-1.67**
	(1.41)	(0.62)	(0.54)
Extended $\text{2023-on}_{i,t}$	-3.82^{+}	-0.65	0.93
	(2.24)	(1.16)	(0.95)
R^2_a	0.115	0.125	0.138
Observations	1,411,007	1,411,007	1,411,007
Quarter-to-Maturity FE??	✓	✓	✓
Bank FE?	✓	✓	
Quarter FE?		✓	
Bank Quarter FE?			✓

Notes: This table presents estimates from the equation

$$100 \times \text{Paid Off}_{i,t+1} = \beta \text{Extended 2023-on}_{i,t} \times \text{Low Capital}_{b(i),t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan is paid off next quarter. Extended $\text{2023-on}_{i,t}$ is a indicator for whether the loan was extended during the stress period, Low $\text{Capital}_{b(i),t}$ is an indicator for whether the bank is closer than the median to its capital buffer. $\tau_{b(i),t}$ and $\alpha_{m(i,t)}$ are bank-quarter and quarters-to-maturity fixed effects. Lower Level $\text{Controls}_{i,t}$ includes Extended $\text{2023-on}_{i,t}$, $\text{Extended}_{i,t}$, Low $\text{Capital}_{b(i),t}$, and $\text{Extended}_{i,t} \times$ Low $\text{Capital}_{b(i),t}$. Relative to the specification above, columns (1) and (2) replace the bank-quarter fixed effects with bank fixed effects effects and bank and quarter fixed effects, respectively. Standard errors, in parentheses, are clustered by bank-quarter. $^{+},^{*},^{**}$ indicate significance at 10%, 5%, and 1%, respectively.

B. MODEL APPENDIX

B.1. Expectation Derivations

Expectations over Sale Offers Whether borrowers choose to extend or sell depends on the sale offer borrowers receive. If n is high enough that it is possible for borrowers to want to sell, maturity outcomes are stochastic and expected payouts come from integrating over κ.

First, I solve for the critical $\kappa^*(n)$ below which borrowers with a debt yield of n choose to sell. If borrowers reject a sale offer, they will either default or extend, making their outside option to selling $V^+_{b,ext}(n) \equiv \max\{V_{b,\text{maintain}}(n), V_{b,\text{neglect}}(n), 0\}$. The optimal κ^* is such that borrowers are indifferent between selling and that outside option. This occurs when $n/\kappa^*(n) - (1+r_m) = V^+_{b,ext}$, meaning that

$$\kappa^*(n) = \frac{n}{1+r_m+V^+_{b,ext}(n)}$$

If $\kappa^*(n) < \underline{\kappa}$, there is no chance of a sale, and the borrower either defaults or extends.[22] That is, either $\pi_{\text{ext}}(n) = 1$ or $\pi_{\text{def}}(n) = 1$ depending on whether a mutually beneficial extension is feasible. If $\kappa^*(n) \geq \underline{\kappa}$, the probability of a sale is $\pi_{\text{sale}}(n) = G(\kappa^*(n)) = 1 - \left(\frac{\underline{\kappa}}{\kappa^*(n)}\right)^{\alpha}$.

The borrower's value function in the region where sales are possible comes from integrating over potential offers:

$$\begin{aligned} V_b(n) &= \int_{\underline{\kappa}}^{\kappa^*(n)} \left(\frac{n}{\kappa} - (1+r_m)\right) g(\kappa) d\kappa + V^+_{b,ext}(n) \int_{\kappa^*}^{\infty} g(\kappa) d\kappa \\ &= n\frac{\alpha}{1+\alpha}\left[\frac{1}{\underline{\kappa}} - \frac{1}{\kappa^*(n)}\left(\frac{\underline{\kappa}}{\kappa^*(n)}\right)^{\alpha}\right] + V^+_{b,ext}(n) \underbrace{\left(\frac{\underline{\kappa}}{\kappa^*(n)}\right)^{\alpha}}_{\text{Pr Sale Rejected}} \end{aligned}$$

The lender's value function comes from applying the sale, extension and default probabilities to equation (1).

[22] Note that at the minimum n such that a sale is possible $(V_{b,ext})^+ = 0$ since the borrower is required a pay down to make them indifferent to default. This means that the minimum n at which a sale could occur is $\underline{n} \equiv (1+r_m)\underline{\kappa}$.

Probability of Eventual Default Denote π_m, π_n, and π_{def} as the vectors of probabilities that borrowers choose extend-maintain, extend-neglect, and default on a grid of debt yield values. Let P_m and P_n denote the transition matrices that give the probability that a borrower who chooses extend-maintain and extend-neglect, respectively, transitions from debt yield i to debt yield j next period.

Then the probability that a borrower with a given debt yield i extends in a given period and winds up at debt yield j is given by:

$$P \equiv \text{diag}(\pi_m)P_m + \text{diag}(\pi_n)P_n$$

and the probability that the borrower ultimately winds up defaulting is given by:

$$\Pr(\text{Eventual Default}) = \lim_{T\to\infty} \sum_{t=0}^{t=T} P^t \pi_{def} = (I-P)^{-1}\pi_{def}$$

These equations take the dynamics for debt yield implied by the model (P_n and P_m) and the solution for equilibrium default and extension probabilities for a given debt yield (π_m, π_n, and π_{def}) and gives the probability of eventual default after a potential string of extensions.

B.2. Numerical Solution

1. Make an initial guess for borrowers' and lenders' values, $\mathbf{V_b}$ and $\mathbf{V_l}$, on a grid of debt yields $\mathbf{n}$.
   (a) I use the values that would prevail if extensions were not an option: $\mathbf{V_b} = \max\{\mathbf{n} - (1+r_m), 0\}$, and $\mathbf{V_l} = \mathbb{1}[\mathbf{n} > (1+r_m)](1+r_m) + (1-\mathbb{1}[\mathbf{n} > (1+r_m)])\Lambda\mathbf{n}/\underline{\kappa}$
2. Take expectations over a log normal distribution to calculate continuation values implied by those value functions (solving for $\mathscr{V}_b(n')$ and $\mathscr{V}_l(n')$).
   (a) Note that $n' = \mu Z n$, where $\mu = (1-\theta\mathbb{1}[\text{neglect}])(1+g)/(1-p)$, and Z is a log-normally distributed variable such that $\mathbb{E}(Z) = 1$. Since the effects of paydowns, neglect, and value appreciation in terms of normalized continuation values are isomorphic to a change in initial NOI, one can take a single expectation (for $\mu = 1$) and use that function to find continuation values associated with other outcomes.
   (b) Expectations are estimated by Gauss-Hermite quadrature, interpolating between grid points. For quadrature points falling off the grid, I linearly extrapolate from the last two grid points to calculate lenders' value functions below the grid and borrowers' value functions above the grid. Other off-grid values as assumed to stay at the value for the last grid point.
3. Use $\mathscr{V}_b(n')$ and $\mathscr{V}_l(n')$ to find borrowers' and lenders' value functions for a given action $a(n,\kappa) \in \{\text{Extend} \times$

$\{\text{Neglect}, \text{Maintain}\}, \text{Default}, \text{Pay off}\} \times p$.

4. Solve for borrowers' optimal actions as a function of n, p, κ.

5. Solve for lenders' optimal p as a function of n.

6. Update value functions using the optimal actions $a^*(n, \kappa)$. Integrating over the Pareto distribution for κ, gives the ex-ante values for borrowers and lenders, $\mathbf{V_b}$ and $\mathbf{V_l}$, over n (see Section B.1).

7. Check for convergence, otherwise return to step 1 with the updated $\mathbf{V_b}$ and $\mathbf{V_l}$.

B.3. Characterization of Equilibrium

B.3.1. Borrowers' problem

I will start by discussing borrowers' optimal decision to default, neglect, or maintain given a particular debt yield and paydown requirement. I abstract from sale decisions here and just characterize which outcomes borrowers select as a function of n and p when a sale offer is not worth taking. Borrowers' optimal selection from these three options determines the outside option to selling—$V^+_{b,ext}(n)$—which in turn determines the likelihood a loan pays off (see Section B.1).

The key boundaries determining where borrowers choose to default are found by setting the values of Extend-Maintain and Extend-Neglect in Table 1 to 0 (the value from defaulting). Call these expressions Equations (DN-B) and (DM-B) for the fact that they implicitly define the locus of points such that borrowers are indifferent between default and neglect and default and maintain, respectively.

$$(1+\nu)n - (r_m + p) + \beta(1-p)\mathscr{V}_b\left(\frac{(1-\theta)(1+g)n}{1-p}\right) = 0 \tag{DN-B}$$

$$n - (r_m + p) + \beta(1-p)\mathscr{V}_b\left(\frac{(1+g)n}{1-p}\right) = 0 \tag{DM-B}$$

The left-hand side of these expressions is clearly increasing in n. For a sufficiently low n, $\mathscr{V}_b(\mu n)$ is small, so higher paydowns reduce cash flows (net of loan payments) more than they increase continuation values. This means that each expression is decreasing in p for a range of low n. Consequently, from the implicit function theorem, these expressions define upward-sloping functions giving the principal paydown such that borrowers are indifferent between default and each extension type for a given n.[23] The upper envelope of these two expressions gives the maximum p that a borrower

[23]The slope of the curves are:

$$\left.\frac{\partial p}{\partial n}\right|_{\text{DN-B}} = \frac{1+\nu+\beta(1-p)\mu_n n \mathscr{V}_b'(\mu_n n)}{1+\beta(\mathscr{V}_b(\mu_n n) - \mu_n n \mathscr{V}_b'(\mu_n)} \quad \text{and} \quad \left.\frac{\partial p}{\partial n}\right|_{\text{DM-B}} = \frac{1+\beta(1-p)\mu_m n \mathscr{V}_b'(\mu_m n)}{1+\beta(\mathscr{V}_b(\mu_m n) - \mu_m n \mathscr{V}_b'(\mu_m)}$$

with a debt yield of n is willing to make without defaulting. This upper envelope is the D-B curve shown in Figure 1.

Lenders are constrained by borrowers' default decisions at low ns and optimally require the largest paydown that borrowers are willing to make. That is, borrowers are indifferent to default for low-n extensions. If continuation value is negligible—namely there's almost no hope of a borrower leaving the region in which they are indifferent to default—$\mathscr{V}_b(n) \approx 0$. For these low values of n, borrowers choose neglect over maintain, and D-B is approximately $p = (1+\nu)n - r_m$. In other words, lenders require all cash flows from the property to go towards loan payments. Since those cash flows are low, this entails interest payments that exceed property cash flows getting capitalized into the loan balance.

More generally, borrowers' maximum paydown is increasing and convex in n. A higher n means that there is both higher cash flows available to the lender (reducing the need for forbearance) and more potential for price appreciation to pull the property into the region where a sale can be profitable for the borrower (making borrowers more willing to make principal and interest payments that exceed property cash flows). The first effect is linear in n and the second convex. Eventually, n asymptotes, meaning that borrowers are willing to make an arbitrarily large principal paydown; DM-B goes vertical when $1 + \beta(\mathscr{V}_b(\mu_m n) - \mu_m n \mathscr{V}_b'(\mu_m)) = 0$.

The second relevant margin is whether borrowers choose to maintain the property. Borrowers are indifferent between M and N when the following equation holds, from setting the payouts to extend-maintain and extend-neglect to each other. When the left-hand side of the equation is positive, the borrower chooses to maintain the property.

$$-\nu n + \beta(1-p)\left(\mathscr{V}_b\left(\frac{(1+g)n}{1-p}\right) - \mathscr{V}_b\left(\frac{(1-\theta)(1+g)n}{1-p}\right)\right) = 0 \tag{M-B}$$

B.3.2. Contracts and Outcomes Chosen by Lenders

When lenders are constrained by borrowers' willingness to accept a principal paydown, the optimal p falls on the D-B boundary defined in Section B.3.1. The pivotal boundary for lenders' management of stressed loans is whether they are willing to provide an extension to a borrower that will not accept a significant principal pay down and lacks the incentives to maintain the property. In other words, are lenders willing to extend a loan on the (DN-B) boundary?

Lender's decisions here amount to whether Extend-Neglect along that boundary gives a higher recovery than foreclosure. Lenders are indifferent between the two when:

$$r_m + p + \beta(1-p)\mathscr{V}_l(\mu_n n) - \Lambda n/\underline{\kappa} = 0 \tag{DN-L}$$

and will prefer to extend loans if that quantity is positive.

For ns above where D-B asymptotes, borrowers are willing to accept any principal pay down and lenders do not need to worry about borrowers neglecting the property. In this area, lenders require the paydown that satisfies the first order condition maximizing their value function. Taking the expression for lenders' value function in equation (1), and noting that for this region of n that $\pi_{\text{def}}(n,p) = 0$, $\pi_{\text{ext}}(n,p) = 1 - \pi_{\text{sale}}(n,p)$ and $\mu(n,p) = \mu_m$, we can express the first order condition as

$$\frac{\partial}{\partial p}\left[\pi_{\text{ext}}(n,p)(p - 1 + \beta(1-p)\mathscr{V}_l(\mu_m n))\right] = 0 \tag{FOC-L}$$

where

$$\pi_{\text{ext}}(n,p) = \left(\underline{\kappa}/\underbrace{(1+n-p+\beta(1-p)\mathscr{V}_b(\mu_m n))}_{\kappa^*}\right)^{\alpha}$$

comes from the pareto distribution, and κ^* is the critical cap rate below which borrowers sell and pay back the loan. (More detail on these derivations are in Appendix B.1.) This says that lenders optimally trade off the loss of immediate principal repayment from an extension $(p-1)$ and the value of future loan payments from the extension $(\beta(1-p)\mathscr{V}_l(\mu_m n))$.[24]

B.4. Calibration

I set $r = 4.5\%$ to match 30-year Treasury yields in the period of stress, and $r_m = 7\%$ to match the 2.5% loan rate spread for CRE loans in Table 1 of Glancy et al. (2022). I set $\alpha = 12.3$ to match the 5% discount required for immediate sales during expansions from Figure 8 in Sagi (2021).[25] I set $g = 0.01$ and $\sigma = 0.1$ to match the statistics on annual rent growth in Table 2 of An et al. (2016), and $\Lambda = .76$ to match the 24% deadweight foreclosure costs in Brown et al. (2006).[26] I set the decline in property values from deferred maintenance to $\theta = 0.045$ based on the additional annualized capital expenditures required of lenders following foreclosure to compensate for previous underinvestment by financially distressed owners from Table 7 of Brown et al. (2006).[27] It is unclear how much of this value decline is lost from inefficiency vs. transferred to borrowers. I assume a 50/50 split, meaning that $.5\theta n/\underline{\kappa} = \nu n$, making $\nu = 0.69$. In the baseline calibration, I set $\chi = 0$ based on the finding from Favara et al. (2024) that large U.S. banks do not engage in zombie lending for C&I loans regardless of capitalization.

[24] This first order condition implicitly assumes that borrowers are able to make an arbitrarily large paydown, which raises the question of why they do not pay off the loan from their internal funds. One could assume that borrowers have a maximum ability to pay back a loan which is less than 1, then the optimal paydown rate is the minimum of the first order condition implied by FOC-L and the maximum paydown rate. p being determined by this first order condition can be interpreted as this maximum paydown constraint not binding.

[25] There is a 5% discount relative to a seller with a two year horizon. I approximate this as the expected discount from a forced sale relative to an investor with three times as many sale opportunities (i.e., in years 0, 1, and 2). The minimum from 3 draws of a pareto distribution is pareto distributed with a shape parameter 3α. Since the expected sale is proportional to $\alpha/(1+\alpha)$, I set α to satisfy $\alpha/(1+\alpha) = 0.95 \times 3\alpha/(1+3\alpha)$.

[26] I use the measure of foreclosure costs that don't account for lenders' required capital expenditures due to deferred maintenance since such costs are captured in the model.

[27] Lenders of foreclosed properties spent had capital expenditure rates of 6.4%, compared to 1.5-2% for nondistressed owners.